

2023 HEALTHTRUST UNIVERSITY CONFERENCE

PLAYING // TO WIN

ALIGNED FOR SUCCESS

OPTIMIZING OUTCOMES

Care During Crisis: Managing Supply Chain Through Natural & Other Disasters

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Medical Director, LCMC Supply Chain

July 19, 2023



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Disclosures

- Jeffrey Carter, M.D., FACS has a vested interest in or an affiliation with Avita Medical, Spectral M.D., PolyNovo and Vericel.
- In lieu of compensation, all proceeds are donated to charities supporting burn injury prevention, education, research or survivor programs.

Note: This program may contain the mention of suppliers, brands, products, services or drugs presented in a case study or comparative format using evidence-based research. Such examples are intended for educational and informational purposes and should not be perceived as an endorsement of any particular supplier, brand, product, service or drug.

Learning Objectives

At the end of this session, participants should be able to:

1. Identify supply chain challenges that might accompany disasters.
2. Describe how ancillary service is comprised with disasters.
3. Recall disaster mitigation strategies.

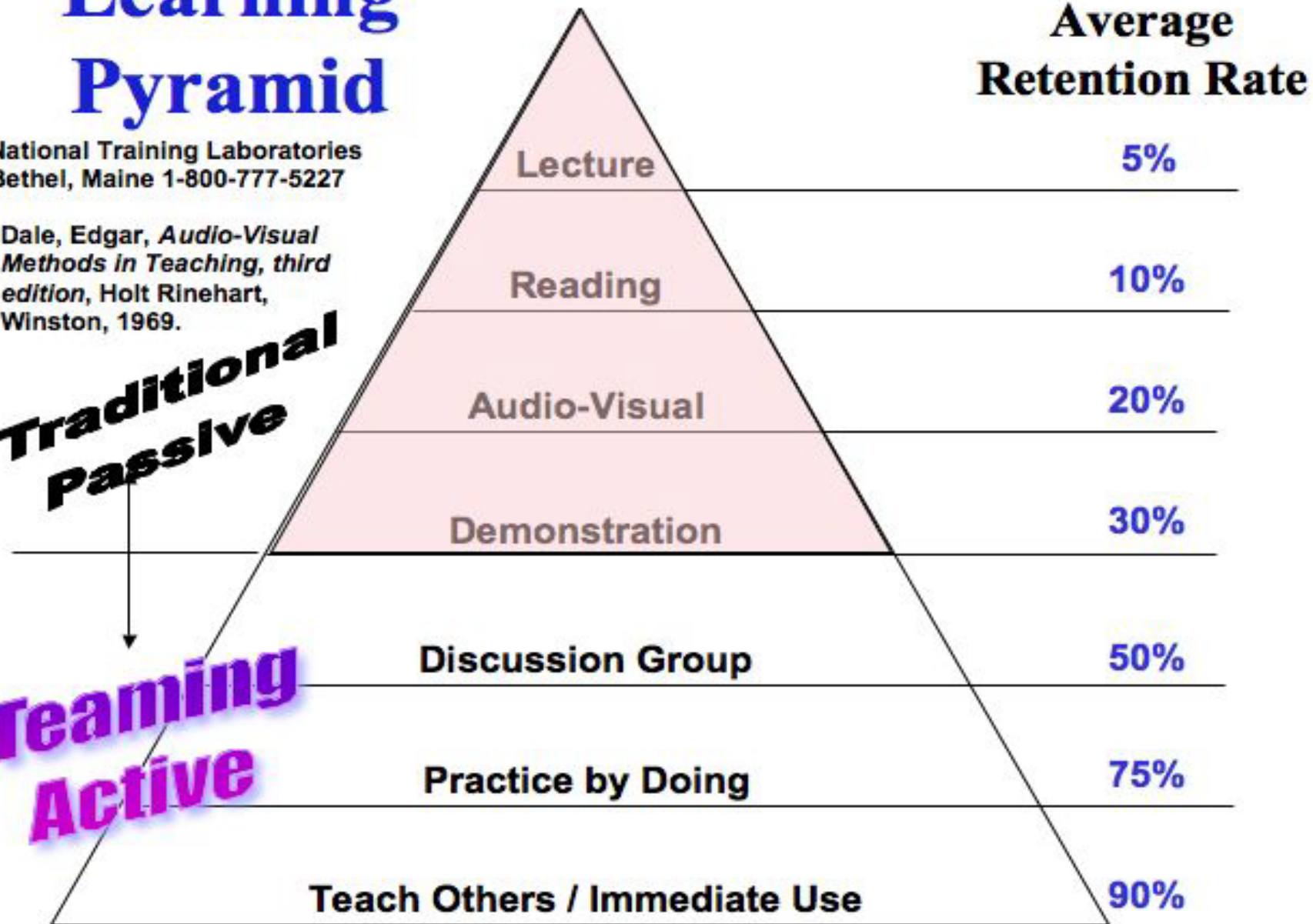
Learning Pyramid

National Training Laboratories
Bethel, Maine 1-800-777-5227

Dale, Edgar, *Audio-Visual
Methods in Teaching, third
edition*, Holt Rinehart,
Winston, 1969.

**Traditional
Passive**

**Teaming
Active**





Defining a Disaster

CE Credit Deadline: 8/25/23

Confidential: Not for distribution

Defining a Disaster



DeepWater Horizon, 2010

The American College of Emergency Physicians defines disaster as:

“When the destructive effects of natural or man-made forces overwhelm the ability of a given area or community to meet the demand for healthcare.”

Sources:

The New York Times. [Deepwater Horizon Ten Years On - The New York Times \(nytimes.com\)](https://www.nytimes.com/2010/04/14/us/politics/deepwater-horizon-ten-years-on) Accessed: May 31, 2023.
Zibulewsky J. Defining disaster: the emergency department perspective. *Proc (Bayl Univ Med Cent)* 2001;14(2):144-49.

Defining a Disaster

The World Health Organization
defines disaster as:

**“A sudden phenomenon of sufficient
magnitude to overwhelm the resources of
a hospital, region or location requiring
external support.”**



June 2022, Trauma Center, Lviv, Ukraine

Sources:

Image by Jeffrey Carter, Lviv, Ukraine, 2023.

Gebbie KM, Qureshi K. Emergency and disaster preparedness: core competencies for nurses. Am J Nurs. 2002 Jan;102(1):46-51.

Disaster Frequency

85% of hospitals reported experiencing a disaster event ***within 5 years*** of survey



Wildfires, Boulder, Colorado, 2021

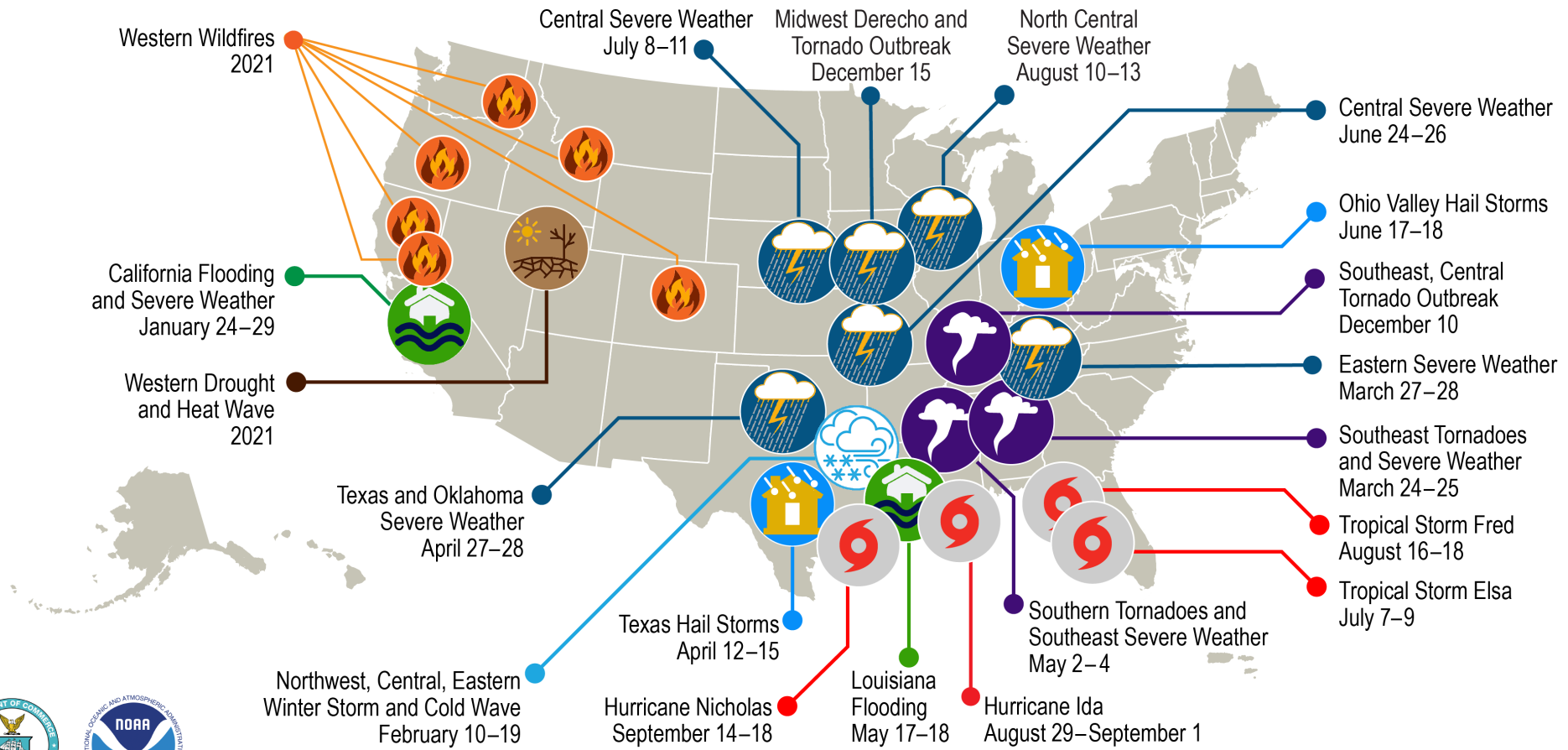
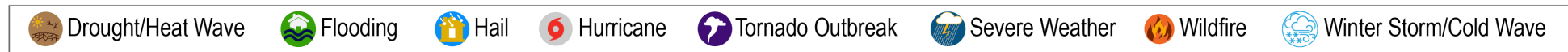
Sources:

Image NPR News. [New wildfire warnings have Boulder, Colo., on edge](#) : NPR Accessed May 31, 2023

Vick DJ, Wilson AB, Fisher M, Roseamelia C. Assessment of community hospital disaster preparedness in New York State. *Jour Emer Man* 2018;16(4):213-27.

Kaji AH, Lewis RJ. Hospital disaster preparedness in Los Angeles County. *Acad Emerg Med* 2006;13(11):1198-203.

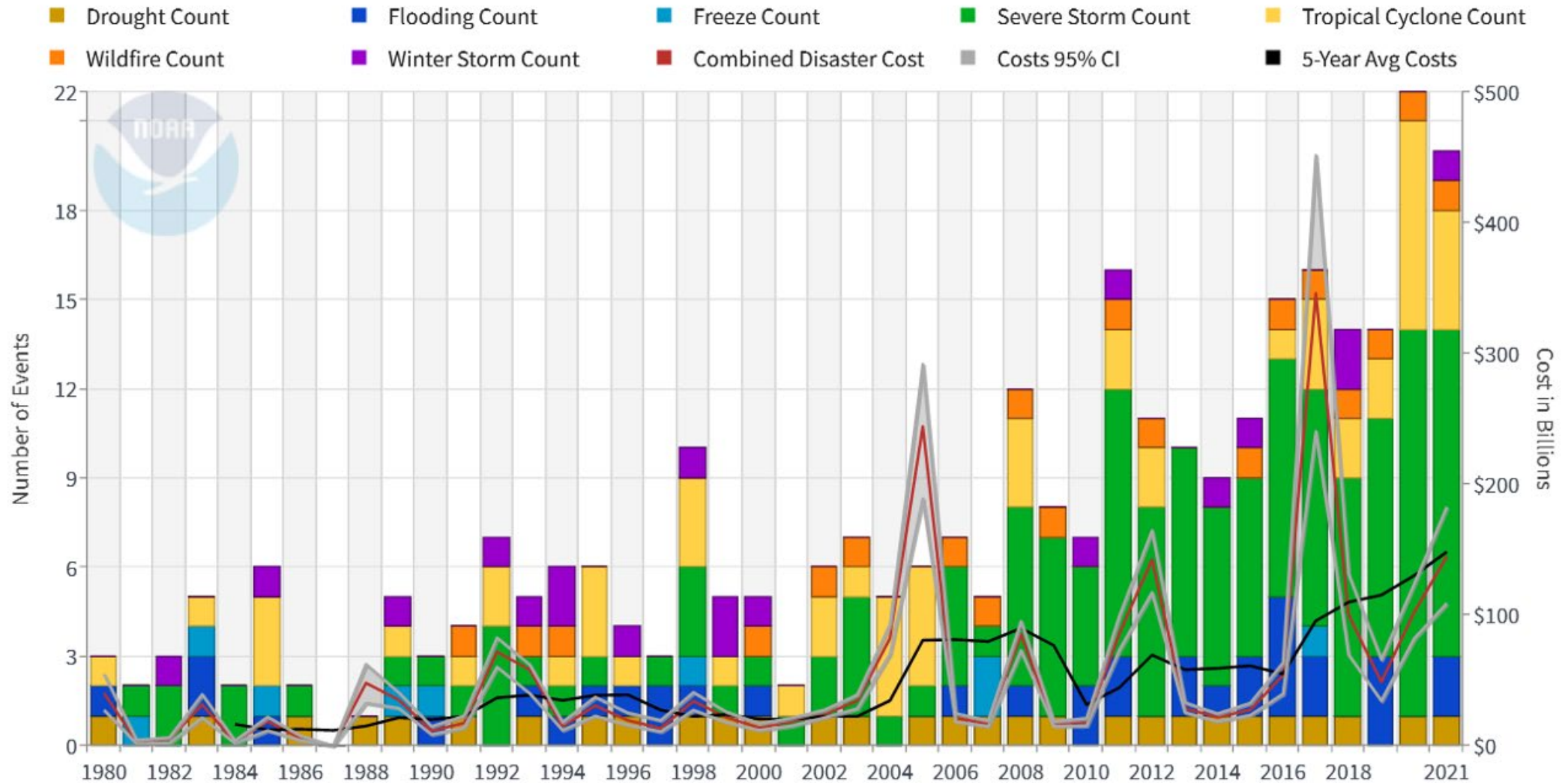
U.S. 2021 Billion-Dollar Weather and Climate Disasters



This map denotes the approximate location for each of the 20 separate billion-dollar weather and climate disasters that impacted the United States in 2021

Source: NOAA Climate <https://www.climate.gov/news-features/blogs/beyond-data/2021-us-billion-dollar-weather-and-climate-disasters-historical> Accessed May 31, 2023

United States Billion-Dollar Disaster Events 1980-2021 (CPI-Adjusted)



Source: NOAA Climate <https://www.climate.gov/news-features/blogs/beyond-data/2021-us-billion-dollar-weather-and-climate-disasters-historical> Accessed May 31, 2023

Apartment Fire | Dec. 2020

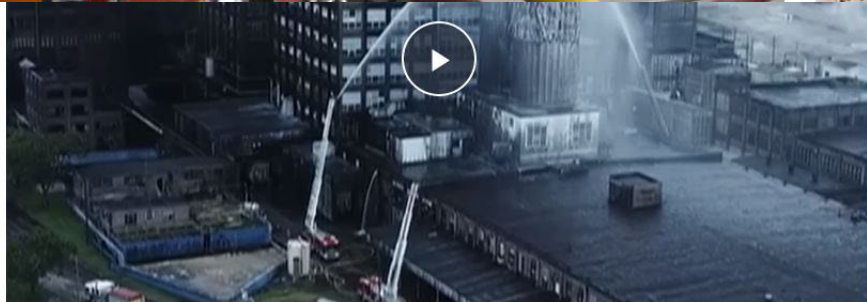
The Times-Picayune | nola.com | THE NEW ORLEANS ADVOCATE

BATON ROUGE | NEW ORLEANS | ACADIANA | GAMBIT | ADORE | SUBSCRIBE

WEATHER | MARDI GRAS | CORONAVIRUS | NEWS | SPORTS | ENTERTAINMENT/LIFE | OPINIONS | HOMES | OBITUARIES | JOBS | CLASSIFIEDS

Mom, kids jump from 2nd-story window to escape flames in Metairie apartment fire, officials say

STAFF REPORT | DEC 28, 2020 - 3:36 PM | 1 min to read



Apartment Fire | Jan. 2021

Families in 98 apartments displaced after fire at New Orleans East complex

62 Shares



Updated: 1:56 PM CST Jan 14, 2021

Infinite Scroll Enabled

WDSU Digital Team

Shay O'Connor
Reporter



Credit: WWLTV

Disaster Frequency

- **85%** of hospitals reported experiencing a disaster event *within 5 years* of survey
- **73%** of hospitals could not *continue operations* beyond one week without help
- **18%** of hospitals believed their *disaster plans were sufficient*



Wildfires, Boulder, Colorado, 2021

Sources:

Image NPR News. [New wildfire warnings have Boulder, Colo., on edge](#) : NPR Accessed May 31, 2023

Vick DJ, Wilson AB, Fisher M, Roseamelia C. Assessment of community hospital disaster preparedness in New York State. *Jour Emer Man* 2018;16(4):213-27.

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Flood Risk to Hospitals U.S. Atlantic & Gulf Coasts From Hurricanes

Rank	Metropolitan Statistical Area	Hospitals at Risk (%)	Beds at Risk (%)	RR Hurricane Strike (Cat 2)
1	Miami, Ft. Lauderdale, Palm Beach	38 (78%)	12,904 (71%)	183.6
2	New York, Newark, Jersey City	25 (20%)	9,271 (19%)	15.4
3	Boston, Cambridge, Newton	6 (15%)	2,240 (24%)	9.6
4	Orlando, Kissimmee, Sanford	1 (33.3%)	221 (45%)	136.5
5	New Orleans, Metairie	15 (79%)	3,471 (82%)	137.7
6	Tampa, St. Petersburg, Clearwater	8 (29%)	2,507 (30%)	89.3
7	North Port, Sarasota, Bradenton	6 (86%)	2,056 (95%)	69.4
8	Jacksonville	6 (43%)	2,004 (48%)	75.0
9	Cape Coral, Fort Myers	4 (80%)	1,542 (95%)	44.3
10	Philadelphia, Camden, Wilmington	5 (10%)	1,639 (11%)	3.2

Source: Tarabochia-Gast AT, Michanowicz DR, Bernstein AS. Flood Risk to Hospitals on the U.S. Atlantic & Gulf Coasts From Hurricanes & Sea Level Rise. *GeoHealth*, 6, e2022GH000651



“Be Prepared”

Be Prepared

Sentinel Species are organisms, commonly animals, ***used to provide advance warning of dangers***, such as toxic exposures, due to increased susceptibility relative to humans.



Mining Foreman R. Thornburg with a canary assessing carbon monoxide gas in 1928.

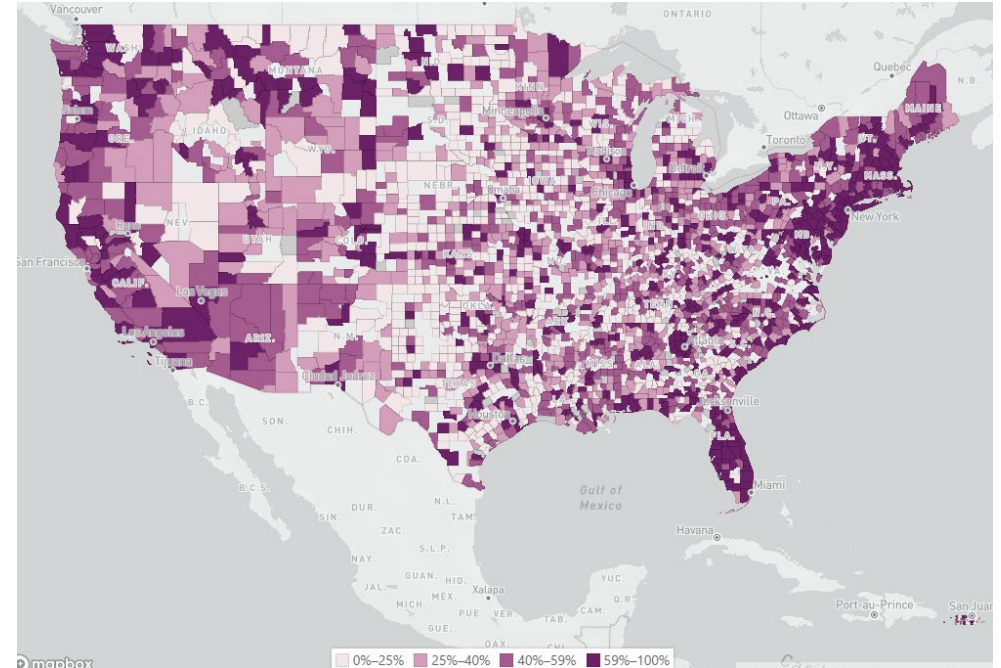
Source: Image Gorge McCaa, U.S. Bureau of Mines [The Story of the Real Canary in the Coal Mine | Smart News | Smithsonian Magazine](#) Accessed May 31, 2023.

Source: National Research Council 1991. *Animals as Sentinels of Environmental Health Hazards*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/1351>.

Source: Burnett, E., Gawaziuk, J. P., Shek, K. & Logsetty, S. Healthcare resource utilization associated with burns and necrotizing fasciitis. *J. Burn Care Res.* 38, e886–e891 (2017).

Be Prepared

- **85%** hospital occupancy rate
- **29%** of hospitals have a *surge capacity of >20 beds*
- **30%** increase in *drug shortages* from 2021 to 2022
- **49%** of hospitals dissatisfied with HPP disaster funding



May 30, 2023 Bed Occupancy Rates by County

Source: Vick DJ, Wilson AB, Fisher M, Roseamelia C. Assessment of community hospital disaster preparedness in New York State. *Jour Emer Man* 2018;16(4):213-27.

Source: Definitive Healthcare & Healthcare Cost Report Information System (HCRIS) Accessed: 05/31/23 <https://www.covidcaremap.org/maps/us-healthcare-system-capacity/#3.5/38/-96>

Source: United States Senate Committee on Homeland Security & Governmental Affairs Chairman Gary Peters. *Short Supply The Health and National Security Risks of Drug Shortages*. HSGAC Majority Staff Report March 2023.

Be Prepared – Time Sensitive Illness/Injury

- **Trauma Care**
 - >330 trauma surgeons **trained per year**
 - >600 trauma centers (~10%) & >90% verified
- **Burn Care**
 - <250 **practicing burn surgeons**
 - <135 burn centers (~2%) & 56% verified



Lady of the Sea Hospital, Galliano, Louisiana Hurricane Ida, 2021

Source: NBC News. [WATCH: Hurricane Ida Rips Roof Off Hospital – NBC 6 South Florida \(nbc-miami.com\)](#) Accessed August 29th, 2021.

Source: Image Gorge McCaa, U.S. Bureau of Mines [The Story of the Real Canary in the Coal Mine | Smart News | Smithsonian Magazine](#) Accessed May 31, 2023.

Source: Ortiz-Pujols M, Thompson K, Sheldon GF, et al. “Burn care: Are there sufficient providers and facilities?” ACS Health Policy Research Institute, November 2011.

Source: ACS Trauma Centers <https://www.facs.org/search/trauma-centers?country=United%20States> Accessed March 22, 2018.

Source: Bazzoli GJ, MacKenzie EJ. Trauma Centers in the United States : identification and examination of key characteristics. *J Trauma* 1995;38:103-10.

Source: EAST Trauma Fellowships <https://www.east.org/professional-development/fellowships> Accessed March 22, 2018.

Source: American Board of Surgery SCC Exam <http://www.absurgery.org/default.jsp?statcrit> Accessed March 22, 2018.

Source: Cohn SM, Price MA, Villarreal CL. Trauma and surgical critical care workforce in the United States: a severe surgeon shortage appears imminent. *J Am Coll Surg* 2009;4:446-52.

Source: *JAMA Appendix Graduate Medical Education 2021-2022*. 2022;11:9951112-46.

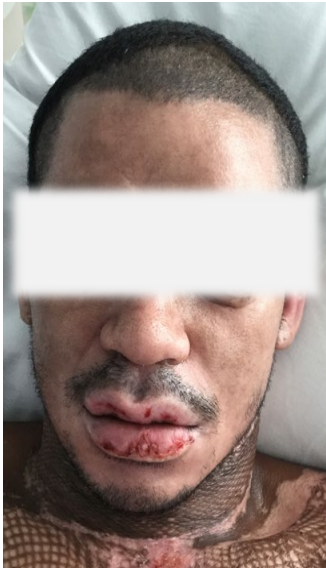
Source: National Research Council 1991. *Animals as Sentinels of Environmental Health Hazards*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/1351>.

Source: Jeschke, M.G., van Baar, M.E., Choudhry, M.A. et al. Burn injury. *Nat Rev Dis Primers* 6, 11 (2020).

Day 3



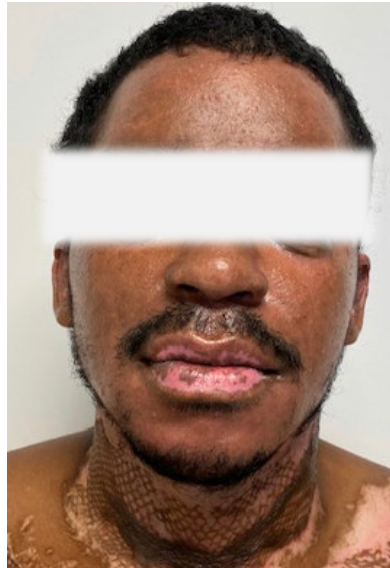
Day 13



Day 21



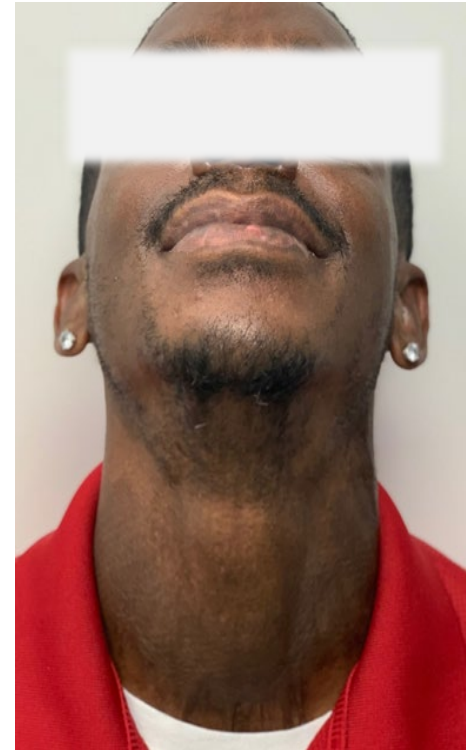
6 Weeks



16 Months



16 Months



Be Prepared

- **Administration for Strategic Preparedness & Response (ASPR)**

- Office of Administration

- ○ **Office of Preparedness**

- Office of Response

- ○ **Biomedical Advanced Research & Development Authority (BARDA)**

- Office of Industrial Base Management & Supply Chain

- Strategic National Stockpile

- HHS Coordination Operations & Response Element

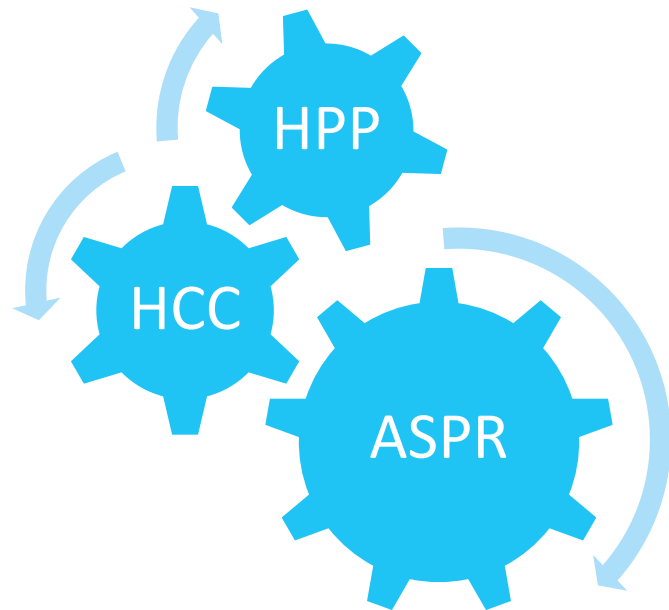


Be Prepared

1. BARDA promotes the advanced development of medical countermeasures to protect Americans and respond to 21st century health security threats
2. BARDA → Medical Countermeasures
 - A. Chemical, Biologic, Radiologic, & Nuclear (CBRN)
<https://www.medicalcountermeasures.gov/barda/cbrn/>
 - B. Influenza & Emerging Infectious Diseases
 - C. Detection, Diagnostics & Device Infrastructure
 - D. Pharmaceutical Countermeasures



Be Prepared



- Push Packs for BURN Disaster
- 21 in Louisiana
- 10 patients/10% TBSA per kit
- Aligns with SNS/BARDA & LERN
- First Responder training
- **ED Burn MCI Cart**

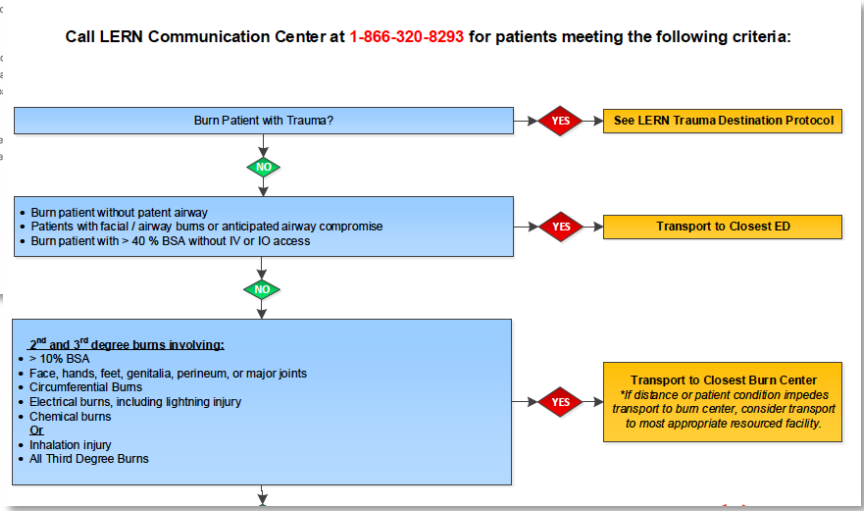
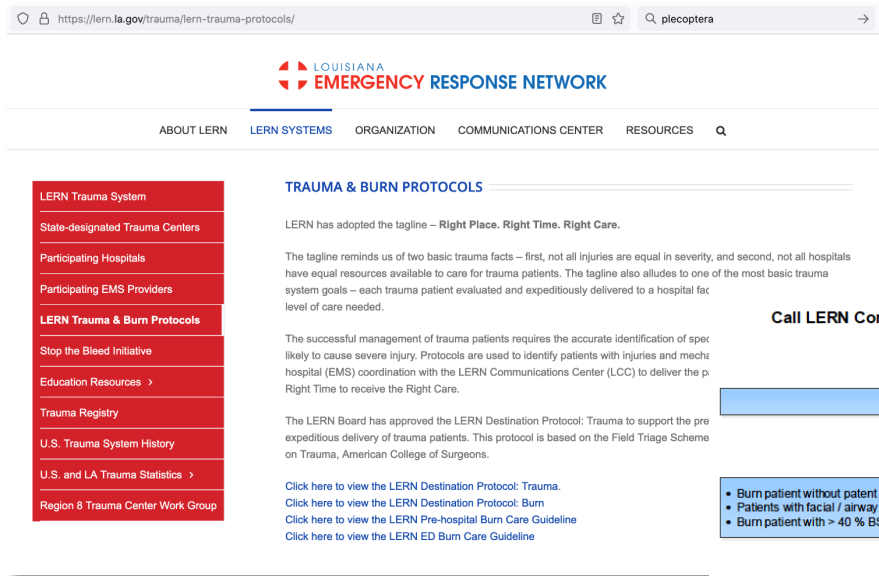


Source: Administration for Strategic Preparedness & Response [Home \(hhs.gov\)](https://www.hhs.gov). Accessed May 31, 2023.

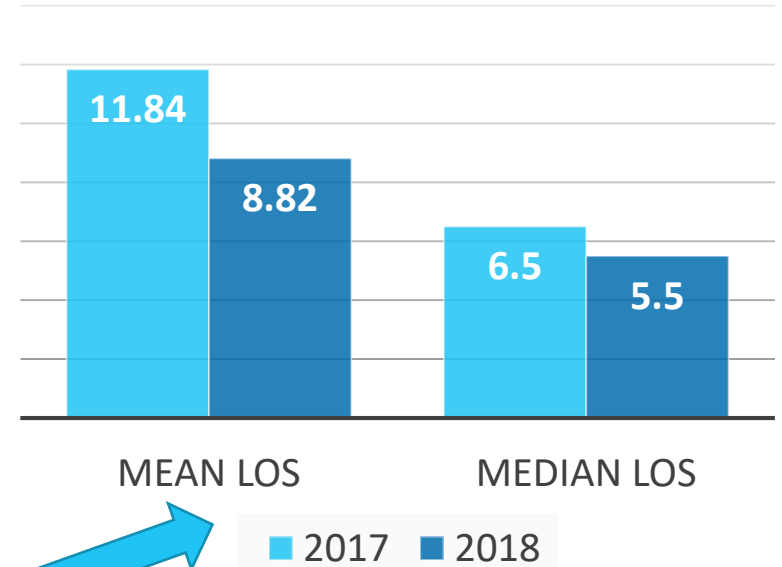
Be Prepared

Established Pre-hospital

- Routing by EMS
- Standardized Care Implemented



Length of Stay for ALL Burn Injury Patients in Louisiana Before & After Routing by EMS



Disaster Survivability Grid

Burn Size (%TBSA)

Age/ years	0 – 10%	11-20%	21-30%	31-40%	41-50%	51-60%	61-70%	71-80%	81-90%	91+%	
0-1.99	High	High	Medium	Medium	Medium	Medium	Low	Low	Low	Expectant	
2-4.99	Outpatient	High	High	Medium	Medium	Medium	Medium	Low	Low	Low	
5-19.9		High	High	High	Medium	Medium	Medium	Medium	Medium	Low	
20-29.9		High	High	High	Medium	Medium	Medium	Medium	Low	Low	
30-39.9		High	High	Medium	Medium	Medium	Medium	Medium	Low	Low	
40-49.9		High	High	Medium	Medium	Medium	Medium	Low	Low	Low	
50-59.9		High	High	Medium	Medium	Medium	Low	Low	Expectant	Expectant	
60-69.9		High	High	Medium	Medium	Medium	Low	Low	Low	Expectant	Expectant
70+		High	Medium	Medium	Low	Low	Expectant	Expectant	Expectant	Expectant	Expectant



Everyone Thinks They Are Prepared Until They Are Not



2021 HURRICANE IDA

**42 BURN INJURIES >10% TBSA IN ~2 WEEKS &
COUNTLESS CARBON MONOXIDE POISONINGS**

Not Being Prepared

- August 29, 2021 → Category 4 Hurricane
 - No Power (over 1 million)
 - No River (power lines in Mississippi River)
 - No Communications (Cell towers down)
 - No EMS/Police/Fire Response
- No Gas
- No Groceries
- No Good

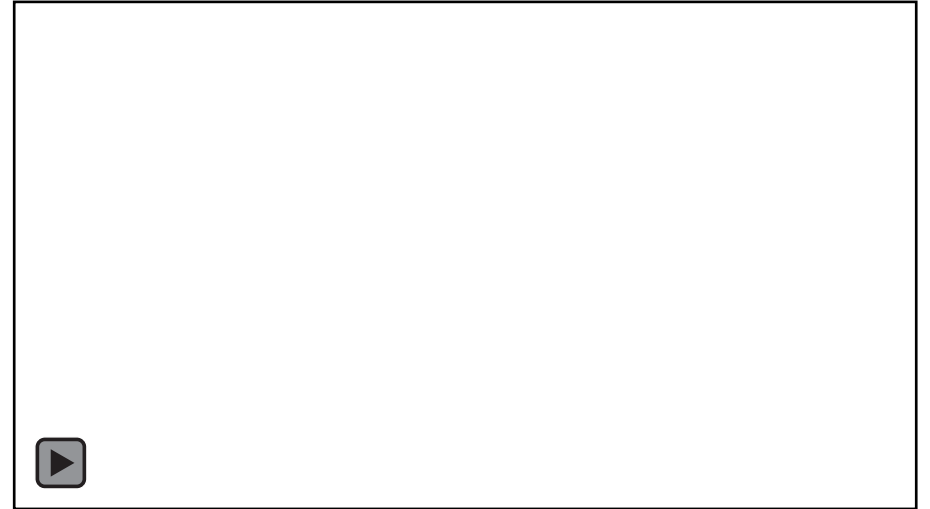


Energy Tower Damaged, St. John Parish, Louisiana

Source: ABC News Hurricane Ida [Hurricane Ida causes flooding and destruction Photos | Image #34 - ABC News \(go.com\)](#) Accessed May 31, 2023

Not Being Prepared

- Electrical, Gas & Generator Injuries
 - 42 patients with >10% TBSA injury
 - >90 patients carbon monoxide/day
 - Hospital staff unable to return
 - Hospital staff unable to leave
 - Limited communications capability



Grade 4 Inhalation Injury Bronchoscopy by Jeff Carter,
New Orleans, LA

Not Being Prepared



- Opened August 2015
- \$1.3 Billion
- Verified Level 1 Trauma & Burn Center
- Premier Regional Academic Medical Center

Power Capability

- Redundant substations
- Six 16-cylinder generators
- 18 Megawatts of power
- Six 300,000 gal of fuel
- 28 days of fuel

Water Purification

- Serial carbon filtration, reverse osmosis & light ionization purification
- 800,000 gal reserve
- 1,500 gal/pumps x 2

Fortification

- 2nd Floor ER entrance
- 5th Floor helipad x 3
- Exterior 105mph projectiles
- Earthquake joints
- Interior HVAC utilities

Not Being Prepared

- Day 1 – Transportation & Communication → 500 meals
- Day 2 – Census doubles → 1,000 meals
 - Nurses rotate sleeping/patient assignments
- Day 4 – Census doubles → 2,000 meals
 - ER MCI cart accessed
 - Surgery all day, everyday
- Day 5 – Altered Standards of Care
 - Staff food rationed
 - Fuel projected to last 14 days



Not Being Prepared

- Day 6 – Life after the storm
 - Toiletry supplies running low
 - Sheets/linens running low
 - Extended wear dressings mandated
 - Rehab gym washer/dryer is coveted (no detergent)
 - Driving to work with a shotgun in a lockdown
- Day 21 – Nurses return to homes destroyed
 - Surgical Operative Work Relative Value Units September 2023 → over 7,000 per surgeon



Not Being Prepared

- Don't take anything for granted
- Don't wait for the rescue
- Don't forget to hydrate
- Prepare to sweat



Communication Capability

- Don't count on cellular
- Find everyone first
- Handheld radios
- Digital antennas
- RITCA

Patient Care

- Minor burn disaster kits across the state
- ED MCI expanded
- OR PAR increased
- Faculty plan revised

Sustainability

- 1 month freeze dried food
- Flashlights & fans
- Inflatable mattresses
- Toiletry bags
- Gravity water filter

Not Being Prepared

- **Communication Challenges**

- **Vertical**

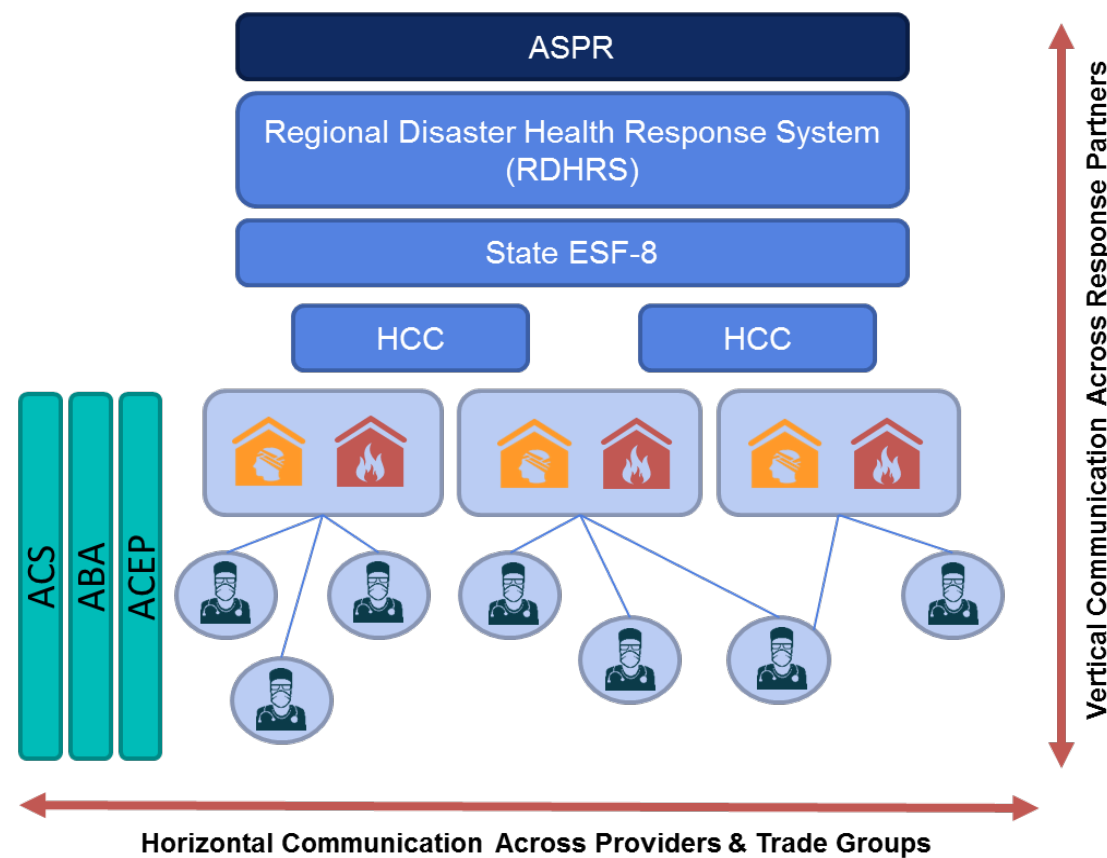
- Interagency
 - Interstate/office

- **Horizontal**

- Interfacility
 - Interprofessional

- **Plan Ahead**

- MOUs
 - EMS Routing





Disaster on Another Level



Ukraine



- 2nd only to Russia in European landmass (600,000km) which is about the size of Texas
- Population 40,000,000 similar to California
- 2021 GDP \$584B (48th)
- 2014 Revolution of Dignity led to closer economic, political & military Western alignment
- 2014 Russian invasion of Crimea
- February 2022 Russian invasion of Eastern regions

Disaster on Another Level

- April 2022 Ukrainian Minister of Defense & Minister of Health contacted GSMSG
 - GSMSG is an NGO experienced in providing high quality training & surgical care in *austere environments*
- Civilian and military participants were recruited & vetted to manage *burn & blast injuries, major extremity trauma &/or critical care*
- Donations in the form of medical supplies were solicited from industry partners by participating physicians coordinating over *\$1.5 million within 30 days*



Disaster on Another Level

- Patients transported from Eastern Ukraine by medical train **(1–2 weeks from injury)**
- **Mechanisms:** Air strikes & tank/land mines
- **Casualties:** Burns & severe polytrauma
- **Notes:**
 - Multidrug resistant organisms common
 - Organisms similar to military wounds from Iraq & Afghanistan¹⁻³



Ambulance from the East, Jeffrey Carter, Lviv, Ukraine



Source: Calhoun JH, Murray CK, Manring MM. Multidrug-resistant Organisms in Military Wounds from Iraq and Afghanistan. *Clin Orthop Relat Res.* 2008;466(6):1356-62.

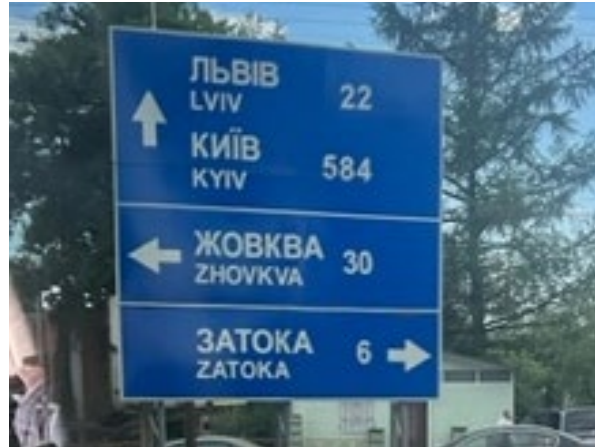
Source: Petersen K, Riddle MS, Danko JR, Blazes DL, Hayden R, Tasker SA, Dunne JR. Trauma-related Infections in Battlefield Casualties from Iraq. *Ann Surg.* 2007;245(5):803-11.

Source: Keen EF, Robinson BJ, Hospenthal DR, Aldous WK, Wolf SE, Chung KK, Murray CK. Prevalence of multidrug-resistant organisms recovered at a military burn center. *Burns.* 2010;36(6):819-25.

Disaster on Another Level



Border Guards, Lviv, Ukraine 2022



City Cemetery, Lviv, Ukraine 2022



Food Service, Lviv, Ukraine 2022

Disaster on Another Level

- No portable oxygen
 - ***Oxygen pillow***
 - ***Call an ambulance!***
- No physician specialist
 - ***Urologist promoted to trauma surgeon → sustained trauma support x 8 weeks***
- No policies
 - ***Drafted 69 pages of policies***
- No protein supplements
 - ***Breakfast/meal replacements***



Lviv Communal Municipal
Clinical Hospital #8

Lviv Burn Center Hospital #8
Ukraine's First Advanced Burn
Life Support Course
Department of Combustiology &
Anesthesia/Critical Care
July 2022



Disaster on Another Level

- No Antibiotic Solution
 - *Homemade Dakin's solution*
- No Surgical Instruments
 - *Carried \$1.5 million instruments & supplies*
- No Dressings
 - *Sterilize sheets of gauze*
- No Books, Journals, Videos
 - *Translated ABLS to Ukrainian*
- Limited Nonsterile Gloves
 - *Frequent hand washing*



Lviv Burn Center Hospital #8
Dakin's Solution
June & July 2022



Lviv Burn Center Hospital #8
Burn Faculty
June & July 2022

Disaster on Another Level

- **Delays = Death**
- Our experience demonstrates an important lesson that conflicts require *civilian healthcare systems to adapt quickly & to accommodate complex injuries that are resource intensive.*
- **No Patient Registry = No History**
- As prudent stewards of history, we should take a page from this terrible war to better understand the consequences of *near peer or peer-to-peer conflict & large-scale combat operations.*



Lviv Burn Center Hospital #8
Surgical Team, July 2022



Lviv Burn Center Hospital #8
Soldier to Soldier July 2022

Three parallel orange diagonal lines of varying lengths, positioned to the left of the 'Thank You' text.

Thank You

Jeffrey Carter, M.D., FACS

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