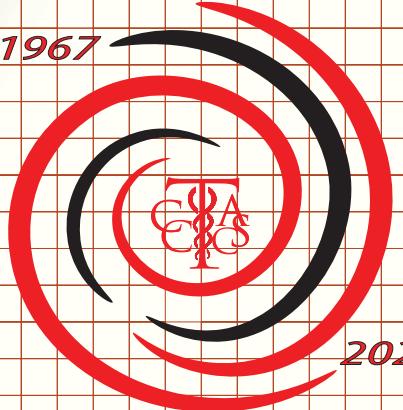




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MATTOX VEGAS TCCACS™

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Medical Disaster Response



2022

March 27, 2022
Las Vegas

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MEDICAL DISASTER RESPONSE

2023

Medical Disaster
Response



MATTOX VEGAS TCCACS™

March 26, 2023
Caesars Palace
Las Vegas

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MARK
YOUR
CALENDAR
TODAY!

March 26, 2023

| SUN | MON | TUE | WED | THUR | FRI | SAT |
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| 5 | 6 | 7 | 8 | 9 | 10 | 11 |
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CAESARS PALACE

LAS VEGAS

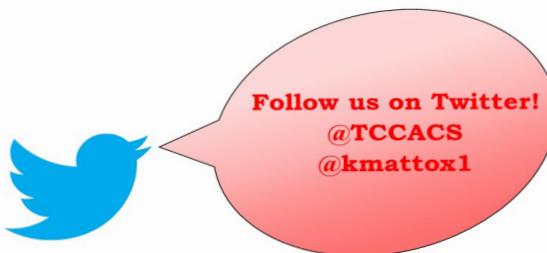
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PROGRAM OBJECTIVES

- 1) Develop strategies to meet challenges of triage, limited resources, palliative care, and ethical and moral risks in pandemic and MCI situations;
- 2) Modify individual situation MCI and disaster responses based on data from past responses;
- 3) Discuss specific clinical response, including managing hypothermia, field and ER resuscitation, expectant care, and whole blood usage in MCI;
- 4) Discuss course corrections when prior plans fail;
- 5) Discuss principles of developing an effective incident command and urgent expansion of hospital capacity;
- 6) Recognize medical challenges of large refugee population relocations

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CME FORMS:

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AMA PRA Category 1 Credits™

The American College of Surgeons designates this Other activity (hybrid format – live and enduring) for a maximum of **9 AMA PRA Category 1 Credits™**. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

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MEDICAL DISASTER RESPONSE 2022
PROGRAM AT A GLANCE
Sunday, March 27, 2022

| Time | Activity | Location |
|---------------|---|--|
| 7:00 AM | Registration Opens | Roman Ballroom Registration Desk Palace Tower, 3rd Floor |
| 7:00 – 8:30 | Continental Breakfast Served in Exhibit Hall | Pompeian Ballroom Palace Tower, 3 rd Floor |
| 7:45 – 9:30 | SESSION 1 BEEN THERE, DONE THAT – LESSONS LEARNED Moderator: Sydney J. Vail | Palace Ballroom 1-2 Palace Tower, 4 th Floor |
| | TITLE | SPEAKER |
| 7:45 – 7:55 | Setting the Stage: Review/Preview 2022 | Kenneth L. Mattox |
| 7:55 - 8:15 | Mass Shooting in Busy Downtown Austin, TX | Jayson Aydelotte |
| 8:15 – 8:35 | The Sturgis Motorcycle Rally: From Start to Finish! | Dustin L. Smoot |
| 8:35 – 8:50 | Migrant Bus Crash | Jeffrey J. Skubic |
| 8:50 – 9:10 | Texas Freezes Over | Alexander L. Eastman |
| 9:10 – 9:30 | Medical Challenges of Large Refugee Population Relocation: The El Paso Experience | Jennifer M. Gurney |
| 9:30 – 9:50 | Panel Discussion | |
| 9:50 – 10:15 | Break & Visit Exhibits | Pompeian Ballroom Palace Tower, 3 rd Floor |
| 10:15 – 11:30 | SESSION 2 CASE MANAGEMENT: WHEN ALL PLANS FAIL Moderator: Alison Wilson | Palace Ballroom 1-2 Palace Tower, 4 th Floor |
| | Panelists: Alexander Eastman Jennifer M. Gurney Matthew J. Martin Chadwick P. Smith Dustin L. Smoot | |
| 11:30 – 12:30 | SESSION 3 NEED TO KNOW BEFORE YOU GO Moderator: Chadwick P. Smith | Palace Ballroom 1-2 Palace Tower, 4 th Floor |
| | TITLE | SPEAKER |
| 11:30 - 11:45 | Tricks in my Took Kit - Five Things I Cannot Live Without | Jay A. Johannigman |
| 11:45 - 12:00 | Advanced Resuscitative Care in the Field and ER: A Bridge Too Far? | Zaffer A. Qasim |
| 12:00 - 12:15 | HICS Without Hiccups: Principles of an Effective Hospital Incident Command System | Sydney J. Vail |
| 12:15 – 12:30 | Disaster Training Aboard the USS San Diego: An Extension of Hospital Facilities in Catastrophic | Rachel A. Callcut |

| | Events | |
|--------------|--|--|
| | SESSION 4 LUNCHEON SESSION Moderator: Kenneth L. Mattox | Palace Ballroom 1-2 Palace Tower, 4 th Floor |
| 12:30 – 2:00 | MASS CASUALTY MANAGEMENT: BASIC PRINCIPLES AND PITFALLS – IS YOUR HOSPITAL READY? Jayson Aydolette | |
| 2:00 – 2:30 | SESSION 5 AUDIENCE INTERACTIVE SESSION BIOLOGICS, RADIATION, AND DIRECTED ENERGY: ARE YOU PREPARED? Session Coordinators: Alexander L. Eastman & Jennifer M. Gurney | Palace Ballroom 1-2 Palace Tower, 4 th Floor |
| 2:30 – 3:00 | SESSION 6 AUDIENCE INTERACTIVE SESSION ETHICAL, MORAL, AND LEGAL RISKS IN DISASTER AND MCI CARE Session Coordinators: Matthew J. Martin & Melissa "Red" Hoffman | Palace Ballroom 1-2 Palace Tower, 4 th Floor |
| 3:00 – 3:30 | Break & Visit Exhibits | Pompeian Ballroom Palace Tower, 3 rd Floor |
| 3:30 – 6:00 | SESSION 7 BEYOND TRIAGE AND RESUSCITATION Moderator: Kenneth L. Mattox | Palace Ballroom 1-2 Palace Tower, 4 th Floor |
| | TITLE | SPEAKER |
| 3:30 – 3:45 | Hospital Emergency Response Team (HERT) | Meghan R. Lewis |
| 3:45 – 4:00 | All Systems Down – Ransomware Has "Kidnapped" your Hospital | Matthew L. Martin |
| 4:00 – 4:15 | Expectant Care: How to Do it Well | Melissa "Red" Hoffman |
| 4:15 – 4:30 | Location, Location, Location: Rapid Hospital Expansion Lessons from the COVID experience | Zaffer A. Qasim |
| 4:30 – 4:45 | Whole Blood: The Ideal Product for Mass Casualty Events? | Richard A. Sidwell |
| 4:45 – 5:00 | Hospital Evacuations Done Right | Stephen L. Barnes |
| 5:00 – 5:15 | Rationale for Rationing: ECMO Access During the COVID-19 Pandemic | Hasan B. Alam |
| 5:15 – 5:30 | Resiliency and Coping in Frontline Healthcare Professionals | Alison Wilson |
| 5:30 – 5:45 | Code Orange in Your EC: Prisoner Bus Crash | Sydney J. Vail |
| 5:45 – 6:15 | Late Breaking News | Kenneth L. Mattox |
| 6:15 – 6:30 | Panel Discussion | |

GENERAL COURSE INFORMATION

Medical Disaster Response 2022 is a one-day course focusing on clinical realities of medical disaster response, not logistics, organizational charts, and the like, while providing practical information that trauma care providers can take home and implement to improve institutional disaster response plans. Information presented is physician/nurse/hospital care oriented and emphasizes that the trauma center, whether a Level 1, 2, 3 or 4, is the foundation of the disaster medical response system.

CONFERENCE REGISTRATION

Registration opens on Sunday, March 27th at 7:00 a.m. The Medical Disaster Response registration desk is in the Palace Tower, 3rd floor, Promenade Level, immediately outside the Roman Ballroom.

GENERAL SESSIONS [Note Location Change from Previous Years]

All general sessions are held in the **Palace Ballrooms 1-2 on the 4th floor of the Palace Tower**. You must have a *MEDICAL DISASTER RESPONSE* badge to enter the General Session. The General Session begins at 7:45 a.m.

CONTINENTAL BREAKFAST

Continental breakfast will be served in the **Exhibit Hall, the Pompeian Ballroom, 3rd Floor** of the Palace Tower. Take the escalator or elevator down one level to the Exhibit Hall. Hours for continental breakfast are from 7:00 - 8:30 a.m., Sunday, March 27th. Morning and afternoon breaks will also be held in the Pompeian Ballroom.

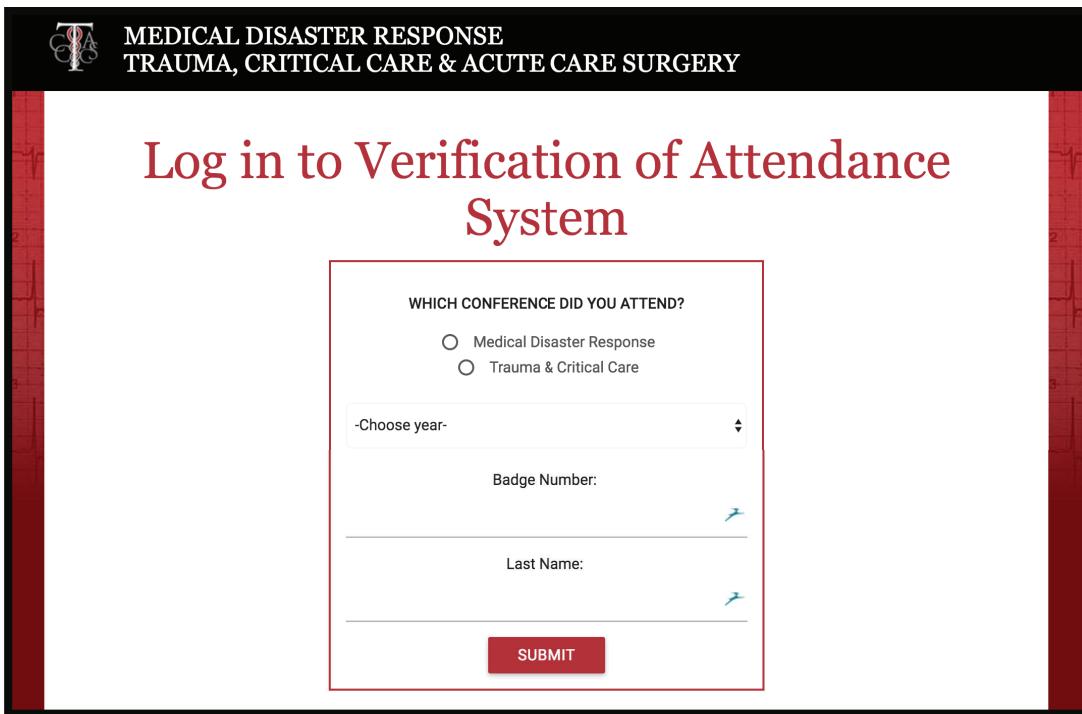
LUNCH SESSION

The luncheon session will be held in the Palace Ballroom 1-2, where the General Sessions have been. The session is moderated by Doctor Kenneth Mattox, and Dr. Jayson Aydelotte will present, ***"Mass Casualty Management: Basic Principles and Pitfalls – Is Your Hospital Ready?"***

BADGES

Your badge must be worn at all times to be admitted to all sessions. If your badge is lost, a replacement is required, and the fee is \$20.00. Your badge serves as your "admission ticket to the General Sessions, Exhibit Hall, and Luncheon Session. **YOUR BADGE HAS YOUR ID NUMBER ON THE BOTTOM RIGHT. YOU WILL NEED THIS NUMBER TO SUBMIT YOUR CME DOCUMENTATION**

ATTENDANCE VERIFICATION, MOC EXAM & CME CERTIFICATES
MEDICAL DISASTER RESPONSE 2022
March 27, 2022
www.mattoxvegastraumacme.com



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- "WHICH CONFERENCE DID YOU ATTEND?" with two radio button options: "Medical Disaster Response" and "Trauma & Critical Care".
- A dropdown menu labeled "-Choose year-
- A text input field labeled "Badge Number:"
- A text input field labeled "Last Name:"
- A red "SUBMIT" button at the bottom.

Your **USER ID** is the **ID NUMBER PRINTED ON THE LOWER CORNER OF YOUR BADGE, OPPosite THE BARCODE**. **TAKE A MOMENT NOW TO INPUT YOUR BADGE NUMBER IN THE BLANK ABOVE, AND/OR NOTE IT IN YOUR TELEPHONE OR OTHER ELECTRONIC DEVICE.**

CME Instructions

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| Step # | Description | Completed? |
|--------|---|------------|
| 1 | Fill Verification of Attendance Form | |
| 2 | Course Evaluation You may SUBMIT this form multiple times. | |
| 3 | Download CME Certificate (not yet available - must complete VOA form and course evaluation first) | |

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STEP 1: VERIFICATION OF ATTENDANCE

- FREE WI-FI provided in the General Session Rooms to facilitate your completing your required forms immediately, during the conference
- You may save and submit this form multiple times

STEP 2: COURSE EVALUATION

- Course evaluation form must be completed for your certificate to be downloaded (Step 3).
- You may complete the forms in stages, following each session (advised), or at the completion of the course

STEP 3: DOWNLOAD CME CERTIFICATE

- **PLEASE ENSURE YOU SAVE A COPY FOR YOUR RECORDS**
- If you note any errors on your certificates, contact Mary Allen IMMEDIATELY at RESTART@AOL.COM or Telephone: 713.798.4557

The Verification of Attendance system for submitting requests for CME credit is available via any device connected to the Internet. Should the Wi-Fi network in the meeting room seem slow because of high usage, you may use your data plan's wireless connection or access the system at another time.



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SCAN THE ABOVE QR CODE TO GO TO THE DISASTER 2022 SYSTEM, WHICH ALLOWS YOU TO SIGN IN TO ACCESS REQUIRED CME FORMS AND DOWNLOAD YOUR CERTIFICATE.

**ONSITE CME WEB SITE SUPPORT
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GENERAL SESSION**

ALSO, SUBMIT YOUR QUESTIONS TO THE SESSION MODERATORS VIA THIS SYSTEM

2022 FACULTY

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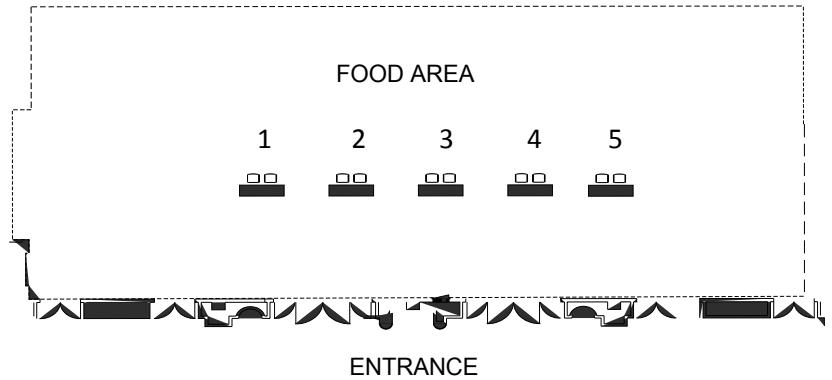
MEDICAL DISASTER RESPONSE

March 27, 2022

CAESARS PALACE - LEVEL 3 - POMPEIAN BALLROOM
LAS VEGAS, NV

EXHIBIT DIRECTORY

1. Trauma Surgery & Acute Care Open
2. United Team Group
3. Strategic Operations
4. OIC Advance
5. MedSol



Medical Disaster Response 2022

Exhibit Directory

MedSol – Booth #5

Medical supply and equipment.

OIC Advance – #4

OIC Advance is a solutions company that offers our FDA Cleared Class II Tens unit. Our portable and compact Tens unit helps address various health issues. Such breakthrough in the medical device industry promotes confidence and wellness; thus enhancing efficiency on life performance. A step to better health! We are focused on clearer solutions for today with an eye to the future for better results.

Strategic Operations - #3

Since 2002, Strategic Operations, Inc. (STOPS) has provided Hyper-Realistic® tactical training services and products to the military, law enforcement, first responders, and other organizations responsible for homeland security. STOPS pioneered the introduction of “Hollywood” style special effects and practices into live tactical training – explosions, weapons, realistic props, foreign language speaking actors, and casualty actors. Since the introduction of medical simulation systems such as the Cut Suit (CS) STOPS now offers Advanced Surgical Skills Packages (ASSP), which together are the world’s only Hyper-Realistic® open surgery simulator (CS-ASSP).

STOPS has added Hyper-Realistic® training support of civilian medical providers to its portfolio of products and services.

STOPS continues to introduce innovative solutions to overcome the challenges of training military personnel, law enforcement personnel, first responders, and medical providers/surgical teams. STOPS is dedicated and focused on maximizing training value by outfitting individuals and organizations with essential training products to accomplish missions and save lives.

STOPS also provides Hyper-Realistic® training environments resembling actual scene conditions offering participants “Stress Inoculation.” Active threats and mass casualty incidents have been increasing in frequency and complexity throughout the United States – throughout the world, law enforcement and medical emergency response teams have struggled to manage actual events. A significant contributor to this reality is the way in which first responders are able to or unable to train for these incidents. Many lack the time, funding, and facilities to adequately prepare. STOPS draws upon many years of experience, since 2002, to provide a fully immersive training environment at the Tactical Training Lab in San Diego, CA or at any location throughout the world.

Trauma Surgery & Acute Care Open – #1

Trauma Surgery & Acute Care Open is the American Association for the Surgery of Trauma's open access journal dedicated to the rapid publication of peer-reviewed, high-quality trauma and acute care research. Trauma Surgery & Acute Care Open provides an interdisciplinary forum for global issues in trauma and acute care surgery and is dedicated to covering epidemiological, educational, and socioeconomic facets of trauma management and injury prevention.

United Team Group – Booth #2

United Team Group is a medical supplier and distributor of a large variety of medical led devices, uniforms, surgical equipment Natural Hemp Creams for Muscles, Joints, Back, Face, Neck and more operating from 2006.

SESSION 1

BEEN THERE, DONE THAT – LESSONS LEARNED

Moderator: Sydney J. Vail

Sunday, March 27, 2022

7:45 – 9:50 AM

Palace Ballroom 1-2

Palace Tower

Emperors Level - 4th Floor

| | |
|---------------------|--|
| 7:45 – 7:55 | Setting the Stage: Review/Preview 2022 Kenneth L. Mattox |
| 7:55 - 8:15 | Mass Shooting in Busy Downtown Austin, TX Jayson Aydelotte |
| 8:15 – 8:35 | The Sturgis Motorcycle Rally: From Start to Finish! Dustin L. Smoot |
| 8:35 – 8:50 | Migrant Bus Crash Jeffrey J. Skubic |
| 8:50 – 9:10 | Texas Freezes Over Alexander L. Eastman |
| 9:10 – 9:30 | Medical Challenges of Large Refugee Population Relocation: The El Paso Experience Jennifer M. Gurney |
| 9:30 – 9:50 | Panel Discussion |
| 9:50 – 10:15 | Breaks and Visit Exhibit Hall Pompeian Ballroom Take Escalator or Elevator Down to 3rd Floor (Promenade Level) |

SETTING THE STAGE

Kenneth L. Mattox, MD, FACS

Course Director
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In 2008, the Program Committee for TCCACS established a new course to be presented in conjunction with the annual Mattox Vegas Trauma Course. It was designed to focus on educating clinical personnel, doctors, nurses, and hospital administrators on managing the clinical aspects of disaster response. At that time, there were many courses devoted to the general and public health aspects of disaster response, i.e., creation of governmental incident commands, on scene triage, disaster drills, and the like. Our goal was and is to provide practical insights based on experience, of what works and does not work when the clinician faces potentially overwhelming numbers of patients requiring urgent triage and care, often in the face of limited resources.

We have selected speakers who draw from personal experiences in meeting the challenges in military war zones, natural disasters, mass shootings, as well as internal disasters in medical facilities, just to name some. Continuing education on blast injuries, ballistics, chemical exposures, radiation, cyberterrorism, and infectious disease is equally important.

The Program Committee methodically considers the medical disaster response program, attempting to compile data on major disasters/mass casualty incidents that occurred during the year, while reaching out to those who have been involved in the responses.

Since the 2021 meeting, COVID-19 continues to confound the scientific communities, practicing physicians, public health personnel, governments, and pharmaceutical companies. The rules and best practices, as well as COVID strains, seem to change monthly. This conference is NOT a “COVID conference,” though some COVID issues will be addressed. For the past two years, the world has been subject to several events that would be termed “disasters” on some level or another, but the COVID-19 pandemic has been the predominant disaster all hospitals and hospital personnel have had to deal with. Many of the “disaster” events, such as personnel, supply, and resource availability, are barriers with every disaster.

It is appropriate to cite this year’s increase in crime and interpersonal violence. The secondary impacts of these is increasing numbers of incidents of all types of trauma – this to be managed in the “COVID-19 environment.”

Program details, as well as instructions for claiming CME and sending questions to Session Moderators are in your syllabus. As in past years, you access the syllabus and CME forms, as well as submit questions to the moderator from your cell, computer, or other android device.

We also encourage you to share your insights on the meeting on Twitter @kmattox1 and on Facebook via TCCACS or Kenneth Mattox. Share the educational “pearls” you learn and your impressions of this first, large, live surgery conference in more than a year.

We welcome you and appreciate your enthusiasm for Medical Disaster Response 2022, as well as your understanding of the unique 2022 differences from past years. While we had to overcome numerous COVID related challenges to bring this conference to you, we had no difficulty in maintaining the high quality of our program and faculty, who always bring to you their superb presentations. We are committed to making this a meaningful and memorable educational experience.

Thanks, and appreciation to our exceptional faculty and incredible support staff, Mary Allen and Lisa Villarreal. Welcome and thank you to our exhibitors, who bring yet another valuable adjunct to the conference, and we encourage you to seek them out during breakfast and breaks in the Exhibit Hall.

WELCOME!

MASS SHOOTING IN BUSY DOWNTOWN AUSTIN, TX

Jayson Aydelotte, MD, FACS

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Austin, TX

In the early morning hours on June 12, 2021 a large group of people were gathered in Austin's 6th street when two rivals recognized each other on the street and began firing at one another injuring 13 people in total. Our hospital is only blocks from this area of town and casualties were brought directly to us. Our Mass Casualty Management plan was not formally activated, but a modified version of the plan was enacted following several principles we practice.

Of the 13, only 6 were brought by EMS, the other 7 were brought by Police. The first to arrive (by Police) was shot in the abdomen and was hemodynamically unstable. Resuscitation was begun, and the patient was taken directly to the operating room. The next 12 casualties followed closely behind, and we established a modified Mass Casualty Management system based on several main principles.

PERSONNEL

On duty that night was a full complement of nursing and tech staff, two Emergency Medicine attendings, one Surgical attending (myself), one surgical chief resident, one surgery intern, two medical students, and one Nurse Practitioner who was assigned to the SICU.

SPACE

Our hospital's emergency department has three main resuscitation bays, each with two beds. Along the same hallway are ten other rooms in that section of the ED. We immediately cleared out any patients from any of these rooms and moved them elsewhere in the ED. After our triage officer was identified we then began dividing the physician workforce to be safely spaced along the hallway.

TRIAGE OFFICER

The chief resident was already upstairs with the first casualty. It was anticipated I would be joining her as soon as possible. For this reason, the most senior emergency medicine physician assumed the role of triage officer and positioned himself in the triage area, which was the front door of the ambulance bay.

TRIAGE CATEGORIES

Immediate and Emergent

We were able to place an emergency medicine attending in one of the resuscitation bays and two emergency medicine residents in the other two bays. The surgery intern and the ICU nurse practitioner were in charge of the several rooms down the hallway. Patients were triaged according to the site of injury and their apparent hemodynamic stability, as quickly measured by consciousness and general appearance. We did not use the radial artery test. Five patients occupied the three resuscitation bays and five more went to the rooms down the hall, two came in shortly thereafter but were walking with wounds to the hands. All the less injured patients had injuries below the knee or elbow. The five who made it to the resuscitation bays had injuries to the mid thigh, chest, shoulder, and flank.

OUTCOMES

None of the patients had any abdominal pain or tenderness. All were hemodynamically normal, and all had palpable pulses in every extremity. The two patients shot in the mid thigh had obvious femur fractures but a good pulse and no active hemorrhage, so all the patients underwent adjunct workups to include CT scans, enabling me to join the resident upstairs in the OR.

The triage officer was able to “float” from room to room. He was able to see each patient and gather important information about each. He then assembled a triaged list of which patients were going to CT in order of importance: any concern for abdominal, then chest trauma went first, followed by all of the lower extremity injured patients with proximity to the femoral and popliteal vessels.

None of the patients had truncal injuries other than minor flesh wounds, and none had any vascular injuries. The fractures were splinted and the patients went to the operating room later that morning for fixation.

The situation was handled in a way that maximized our ability to deliver adequate ATLS care for all the patients with the available people on hand.

BACKUP

Surgical and Emergency Medicine backup was never called in. Our trigger was to call in another team if we had to open another room at the same time, which we didn’t have to do.

REFERENCES:

None

STURGIS MOTORCYCLE RALLY: MEETING MULTIPLE CHALLENGES

Dustin L. Smoot, MD, FACS

Surgical Institute of South Dakota
Sioux Falls, SD

The Sturgis Motorcycle Rally is an annual event held in the Black Hills of South Dakota. What started from humble beginnings has now grown into the largest motorcycle rally in the world. Conservative estimates put the financial impact on the Black Hills at around \$800 million dollars for the week-long event seeing 500,000-800,000 riders annually. Sturgis itself is a small community of 6000 people, with the entire state of South Dakota only home to roughly 800,000 total, so the now week -long event creates some significant planning issues for the community and surrounding area.

First started in 1938 by a group of Indian Brand Motorcycle riders, it has been held without interruption every year, except 1942 and 1943 due to gas rationing. Starting as a weekend of flat track motorcycle racing in 1938, it slowly grew through the decades. The eight riders that participated camped in the Indian Motorcycle dealers back yard, and his wife provided food, making the initial planning phases quite subdued. Its slow growth rate over the ensuing decades allowed the local, state and federal agencies the ability to plan for what the rally has become today.

The 1940's brought more of a "show" with the racing. The races grew to about 150 participants, but people started coming to watch the stunts that were added for the crowd. These were some of the original trauma patients, as they entertained with board wall crashes, ramp jumps, and head on collisions with automobiles. The 1950's brought more of the social flare to the races. Several thousand people would come for a whole weekend of racing, stunts, and carnivals, but things remained relatively calm allowing planning for the event to be brief and controlled.

The next several decades would see the rally grow to a full 5-day event. The races continued, but the "other" events took over as the predominant draw. The outlaw biker gangs began attending in the 1970's, which brought a different element to the rally. In 1976, the highway was started on fire, and bikers shot at first responders. Such actions forced local leaders to start looking at the rally as something that required intricate and coordinated efforts to plan appropriately.

Continued growth was present throughout the 1980's and 90's until it reached its current average census of roughly 500,000 riders. The State has become involved to help the local government plan for the event and coordinate a federal response as well. Every facet of the current rally requires careful planning. As outlined in Figure 1, the State of South Dakota has organized the Sturgis Motorcycle Response throughout several state agencies with some integration with federal assets.

The Bureau of Technology is responsible for communications among medical, first responders, hospitals, police, and even the National Guard throughout the rally to maintain seamless integration of several processes. Often discussed as a significant burden during post disaster evaluation briefings, communication is of the upmost importance to make sure any coordinated response can happen with speed and accuracy.

The Department of Transportation is responsible for traffic movement during the rally. Significant changes happen with reduction of speed limits within 20 miles of Sturgis on the Federal I-90 interstate. Not only is traffic movement of importance, but planning for the event has noted that large pile ups of motorcycles create a significant traffic flow issue not only for the locals, but also for any emergency

personnel that may need to respond to “events”. Heavy machinery is staged along I-90 in the event of a large-scale traffic accident so that the roads can be cleared to allow for continue ingress and egress from the area.

The Department of Public Safety deals with fire hazards and response. They also coordinate any need for search and rescue and long-term mitigation response of a mass disaster event. They are also tasked with managing the actual events, should they occur.

The Department of Public Health coordinates the hospital response. This isn’t just the local response but also the transfer agreements for trauma facilities within a 5-state area in the event of overburdened local facilities. They also coordinate patient movement. This involves assets, including ACLS and BLS ground units, private flight rotor and fixed wing, mass causality buses for the walking wounded, and even national guard Blackhawk medivac units. At times, roadways can become completely blocked with traffic, and air transport is the only means available for patient movement. Throughout the week, several “off-site” large events happen in both Wyoming and Montana requiring staging of transport assets closer to these events on those days.

The other contingencies that the Department of Public Health plans for are not just trauma needs but also medical needs. The average age of the Sturgis Rally participant is now in the 60’s. With this comes a whole host of chronic and acute medical needs outside the realm of trauma care. Resources are bolstered for emergency cardiac care and general surgical needs during the rally to help handle the doubling of the state’s population for that week. Destination dialysis is not allowed, however, as the resources locally do not support any increase over local needs.

Should a mass fatality event occur the Department of Health is also in charge of coordinating efforts locally and regionally. Mobile morgues and autopsy units are staged in the Black Hills to allow for effective response, if needed. They also coordinate death certificates and all arrangements that would be necessary in such an event.

The Bureau of administration helps coordinate planning for public utility needs. An extra 500,000 people put an enormous strain on sewer systems, public water supplies, electricity needs, and even such things as cell phone bandwidth availability. All these things are planned for with coordination through the state including the use of multiple temporary cell phone towers that are brought in just for the week.

The significant influx of people into a confined area for the week also gets the attention of multiple federal agencies that provide their support. These agencies include FEMA and HHS for disaster response planning, whether man made or natural. ATF, FBI, and DEA all coordinate with local law enforcement agencies both for disaster response as well as monitoring. Events such as a conventional bomb or even radioactive devices are planned for, and monitors are placed throughout the event. Homeland security is also involved if any significant threat may be planned against the gathering.

Once all the agencies involved have their plans of actions in place, tabletop exercises are continually run for the last several months of the planning phase. These allow for both weather related events and for manmade disasters. Every department has sits at the table to allow for differing points of view and planning for each exercise and defining of priorities for each possible scenario. Each year, the planning becomes more integrated and expansive, with lessons learned from the previous year integrated into subsequent years planning.

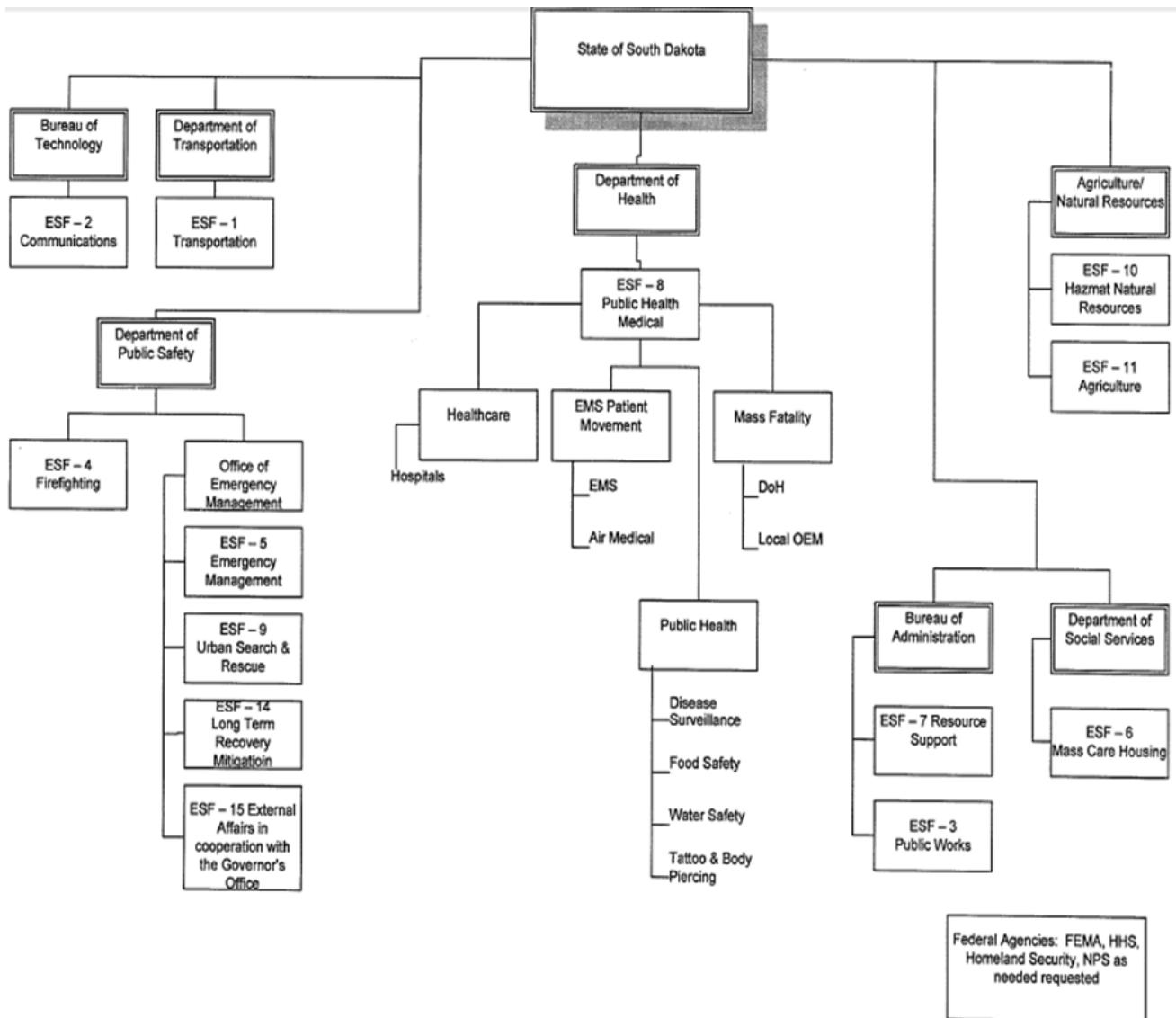


Figure 1.

MIGRANT BUS CRASH

Jeffrey J. Skubic, DO, FACS

Trauma Medical Director
Doctor's Hospital at Renaissance
Assistant Professor of Surgery
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Edinburg, TX



THE EVENT

On Wednesday, August 4, 2021, during the afternoon hours, a multi-passenger van was travelling rapidly north coming from the McAllen – Reynosa border area heading toward San Antonio. All of the seats except for the driver's had been removed from the 15 passenger van to fit a total of 30 onboard passengers that were travelling that day. At around 1600, several miles before the Falfurrias United States Customs Border Patrol (USCBP) checkpoint, the van attempted to make a right turn and crashed into a utility pole at high speed. The driver plus nine other passengers died on scene.

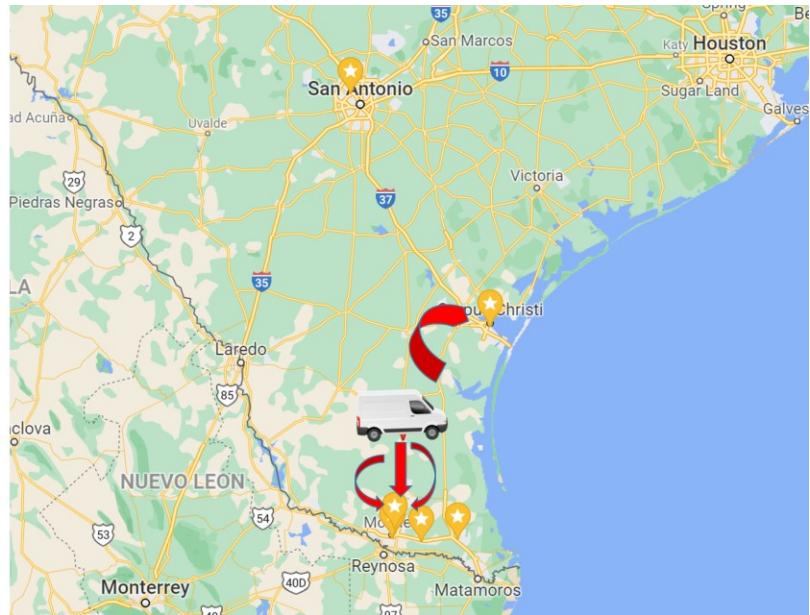
Shortly after, local EMS arrived and began triaging patients. Local EMS began calling for support to other known EMS agencies directly. They contacted HALO-flight in Corpus Christi and RGV Angel Flight in McAllen for air support. Word reached other agencies such as Weslaco EMS, who immediately began mobilizing their multi patient AmBus. As EMS began arriving, there was some confusion about where patients should be taken, as this event occurred in a rural area not near any trauma centers. Arguments ensued among EMS agencies on scene.

Finally, the chief EMS agent from Pharr arrived on the scene and began to try to tame the chaos. He had to re-triage all patients. Still EMS agencies were not acting in coordination. One rotor headed with a patient to the nearest level 1 trauma center (DHR Health in Edinburg). The other rotor headed to a level 2 in Corpus Christi (Spohn), although there were several other trauma centers closer. The remaining patients were sent by ground transport. In total, two patients were taken to Spohn, eight to DHR Health, seven to McAllen Medical Center (level 2) and three to Rio Grande Regional (Level 3), one of which was later transferred to DHR Health. The majority of the transported patients did not have life threatening injuries.

Several patients had procedures performed at trauma centers after arrival. Ten patients died on scene; there were no deaths of patients who reached a trauma center. Of those who reached a trauma center, one-third tested positive for COVID-19 infection. Only one patient out of twenty transported required an inter-facility transfer to a higher level trauma center.

Encino, Texas

DHR Health (Level 1) - 50 miles
McAllen Medical (Level 2) – 55 miles
Rio Grande Regional (Level 3) – 56 miles
Valley Baptist (Level 2) – 75 miles
Spohn (Level 2) – 100 miles
UTSA (Level 1) – 200 miles



DISCUSSION

Illegal immigration from Mexico into the United States has been going on for many years; however, recent changes with border patrol have shifted the migration pattern Eastward away from the California-Mexico border area into Arizona, New Mexico, and Texas borders areas.¹ In a recent review of USCBP patient encounters in the El Paso sector, the second most common reason for evaluation was trauma (42%), with motor vehicle collisions (MVC) being the mechanism of injury recorded for 22% of these traumas.² A study on deaths from crossings along the border from Yuma, Arizona to El Paso, Texas found the leading cause of death to be heat exposure (61%) followed by MVC (8%).³ Recent findings from a Rio Grande Valley single institution study of border crossing related injuries found MVC to be the third most common mechanism.⁴

It does not seem these border related injuries and deaths will cease anytime in the near future. As recently as December 3, 2021, another death related to a high speed MVC occurred again in Encino, Texas.⁵ It would behoove those of us working in border areas to improve upon our mass casualty system response related to border events.

DEBRIEF

There seems to be a lack of awareness of initial on scene EMS personal and available resources in South Texas. South Texas is a growing region and currently contains three EMS rotor services, an AmBus, two level two trauma centers, and a level one trauma center. Much of this system has been put into place in only the most recent few years and could explain the lack of awareness. All agree that all EMS in South Texas need to be fully aware of regional capabilities.

A designated incident commander needs to be chosen early and take full command. For mass casualty events, there needs to be swift decisions made with little time for argument. Having to triage and re-triage patients is inefficient and may be necessary but would be avoided with proper planning.

Trauma plans exist for the different Regional Advisory Councils; however, rural events may occur in areas which have EMS from multiple RAC's responding. Such was the case in this incident occurring in rural Brooks County and having responses from both CBRAC and TRAC-V. Better communication is needed between the different RAC's and EMS. Both RAC's should be familiar with trauma plans for neighboring RAC's, even though they may not be governed by them on a daily basis.

For rural mass casualty events, your emergency systems, such as air support and AmBus support, should be activated early on in the course of events. Rural areas are going to have limited local EMS support; therefore, local EMS should be calling for these extended resources early on – even if they fall within a different RAC region geographically.

Several of the patients sent to trauma centers tested positive for COVID-19 infection upon arrival. Don't forget universal precautions for trauma healthcare workers. Excitement and tension rise during mass casualty events. While preparing for intake of patients during the mass casualty event, don't neglect your personnel and forget to equip them to protect themselves properly.

Lastly, after an event like this, do not forget to debrief at both institutional and regional levels. For mass casualty events, many organizations are involved. Debrief as a large team, so you can prepare yourselves better for the next event. There will be a next time – I guarantee it.

LESSONS LEARNED

Activate Mass Casualty Events Early

Designated Incident Commander from the Beginning

All EMS in region need education on available resources

Triage, but re-triage if you need to

Activate Air Support / Ground Support Early

Triage patients according to the mass casualty plan

Treat all patients as if infected (universal precautions)

Debrief

Perform better next time

Table I. Patients Transported to DHR Health

| Age | Sex | LOS (days) | Injuries |
|-----|-----|------------|--|
| 35 | F | 2 | Facial Lac, C6 fx, nasal fx |
| 26 | M | 1 | Scalp lac, concussion, Left ulnar Fx, Left fibula Fx |
| 18 | F | 1 | Neck pain, abrasions, concussion |
| 49 | F | 1 | Facial Fx's, Pelvic Fx's, L 12th rib Fx, concussion |
| 21 | M | 1 | Facial Lac, R hand lac, +Abd seat belt sign |
| 36 | M | 2 | R hip dislocation, R acetabulum Fx, leg laceration |
| 37 | M | 0 | Scalp lac |
| 41 | M | 0 | None |
| 57 | M | 2 | L ribs 8-11, R rib 3, Sternal Fx, Pulm contusions, Facial Fx's |

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TEXAS FREEZES OVER

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BLUF

Texas' winter weather event in February 2021, while neither the coldest nor the wettest, caused the largest disruption in public and private utilities in the state's history. This disruption of an entire critical infrastructure sector led to a loss of life and function, exposed deep flaws in state/local/federal preparedness in the healthcare and other sectors, and had a profound economic impact on the State of Texas.

INTRODUCTION

Officially designated Winter Storm Uri, Texas will never forget the winter weather that struck the state in February 2021. Dubbed by many as the "Perfect Storm," not for the weather, but, instead, for the flaws in planning, utilities, and response that were laid bare, Uri will persist as one of the costliest disasters ever to strike the State of Texas. With winter weather from February 15-18, 2021, what many thought would be the opportunity to get a rare glimpse of snow and ice turned into a nightmare during which 69% of Texans lost power and 49% lost water service. By virtue of the weather, coupled with this utility interruptions, 210 people lost their lives, and according to the Dallas Federal Reserve, the total economic impact from this storm ranged between \$80 billion to \$130 billion dollars.¹

Texas' power grid is unique, as it is not connected to either the Western or Eastern Interconnection, the only State in the United States with this unique setup. As such, more than 90% of Texas relies on the Electric Reliability Council of Texas (ERCOT)—an entity regulated by the Texas Public Utility Commission. ERCOT lacks its own electricity infrastructure; hence, relies on power generation companies, electricity providers, and other entities that make up wholesale energy market. During Winter Storm Uri, what were supposed to be rolling blackouts to preserve electric grid integrity turned into more than 136 consecutive hours without power when the temperature stayed below freezing the entire time.

To understand this disaster and begin to understand some of the lessons now becoming clear requires a broad review not only of the Texas electrical and utility system, but of some common cold injuries as well as the impact on other critical infrastructure sectors like healthcare.

TEXAS: RUGGED, TOUGH AND A VULNERABLE ELECTRICAL SYSTEM

More than 26 million Texans rely on ERCOT for electricity, nearly 90% of the state's population. Uniquely, ERCOT lacks a proprietary energy production infrastructure. Table I lists the common sources of energy production, produced/distributed/sourced/sold by more than 1,800 active market participants who work with ERCOT in the provision of electricity to Texans. However, during Uri, it was this very federated system that failed to deliver to Texas leading to disastrous consequences.

Table I. Sources of Texas Electricity

| | |
|--------------------|-------|
| Natural Gas | 51% |
| Wind | 24.8% |
| Coal | 13.4% |
| Nuclear | 4.9% |
| Solar | 3.8% |
| Other | 1.9% |
| Storage | 0.2% |

Source: ERCOT

While multiple reports are issued annually in terms of both forecasting (energy requirements and weather) as well as preparedness, none of these foretold either electricity demand or the ultimate demise of the reliability of the Texas electrical grid in the face of this weather event. Uri exceeded planning assumptions weather-wise. As mentioned above, DFW airport reported more than 135 hours of consecutive freezing temperatures and Waco reported more than 205 hours. By some reports, ERCOT underestimated peak energy demand by 14% and this, coupled with errors in weather forecasting, led to the instability in the ERCOT system.

Within hours, many residents experienced deteriorating conditions in their homes, many with temperatures that fell below freezing. According to the University of Houston, of the Texans who lost power, their average duration of disruption was 42 hours. For those that lost water, discussed below, their average disruption was 52 hours.² More than 30% of Texas suffered significant damage to their homes (including this one). However, individual homeowners were not the only ones effected by this winter storm and its consequences. The healthcare sector impact will be discussed in detail shortly. Supply chains, already devastated in many ways by the impact of COVID, were additionally disrupted. For example, the Texas chemical manufacturing sector, making up approximately 75% of US capacity of the production of ingredients needed for disinfectants, pesticides and plastic bottles was damaged requiring repair. Some estimated that more than 20% of national capacity was diminished by and after the storm, with the impact lasting for months. Disruptions in the transportation industry, with both road and rail unavailable due to weather, further exacerbated supply chain woes related to the storm.

Agriculture, a critical sector to many parts of Texas that also has a national impact, was also devastated by the storm. Some experts estimated more than \$1 billion dollars in direct damage here alone, with ranchers not only losing cattle, sheep, poultry, and goats to the storm, but also losing much of the feed grain that goes to sustain these animals. Dairies were forced to dump milk, and vegetable farmers in some locations lost more than 75% of their crops. Economic and food security impacts will continue for years as some crops (e.g. citrus) take years to recover, and, hence, the impact perpetuates.

In addition to the above critical power outages, the loss of water service was profound, with more than 49% of Texas affected during the storm and an additional unknown number affected by “boil water” notices due to deficiencies in water treatment weather durability. Not just single-family homes, but businesses, airports, healthcare facilities, and many other occupancies were affected by this critical outage. As surgeons and physicians involved in disaster preparedness, consider your own family’s preparedness—e.g. how much potable water do you have at your home right now? This is often overlooked by many and remains a critical vulnerability in healthcare facilities as well. A loss of water services causes catastrophic impacts on the operational readiness of most facilities who, in addition to being vulnerable, are dependent upon contract water delivery to mitigate a utility outage. In the case of

Winter Storm Uri, this water delivery simply was not available in any semblance of a timely fashion and hence healthcare facilities were among the many occupancies profoundly affected.

COLD INJURIES: THE BASICS

Human skin, like many other organ systems, functions best at 98.6 degrees F. Deviations in either direction, hot or cold, causes not only decreases in cellular enzymatic functions, but in the case of cold injury, as crystals and ice forms in cells, sometimes direct structural damage. While core body temperature remains an insensitive predictor of the most common cold injuries, temperatures below 88 degrees F often represent an inflection point below which permanent cellular damage often occurs. From a tactical / preventative standpoint, cold injuries are uncommon with brief, limited exposures to even frigid ambient temperatures (below 55 degrees for us Texans!). However, the risk of significant cold injuries increases with prolonged exposure, conditions of limited blood flow, low caloric intake and cases of insufficient cellular oxygen tension (e.g., high altitudes). Cold injuries are often divided into freezing and nonfreezing injuries, and include hypothermia, frostnip, chilblains, immersion (trench) foot and frostbite.³ While there are other conditions that typically present in cold conditions (acute mountain sickness, snow blindness) they are beyond the scope of this talk/syllabus.

Hypothermia

Hypothermia occurs when core body temperature falls to the point that cerebral and motor functions are impaired. While this can occur at any temperature below normal human body temperature, it is much more common in extreme cold weather. Common etiologies can be prolonged cold exposure, sometimes at altitude, and exacerbated by wet conditions, poor clothing/protective equipment, lack of caloric intake/poor nutrition and fatigue/exhaustion. Perhaps most important is early recognition—the signs of which are often referred to as the “umbles”—stumbles, mumbles, fumbles and grumbles—all indicative of impending system slowdown or failure in response to decreasing core body temperature. Hypothermia can be subdivided into mild, moderate and severe classes. Table II lists the types and clinical features of the various classes of hypothermia.

Table II. Clinical Features of Various Classes of Hypothermia

- Mild hypothermia** - core temperature 98.6°-96°F
- Shivering - not under voluntary control
 - Can't do complex motor functions (ice climbing or skiing), can still walk & talk
 - Vasoconstriction of peripheral vessels manifesting as pallor
- Moderate hypothermia**-core temperature 95°-93°F
- Dazed consciousness and/or irrational behaviour e.g. paradoxical undressing - person starts to take off clothing, unaware he is cold
 - Loss of fine motor coordination - particularly in hands - e.g. can't zip up parka,due to restricted peripheral blood flow
 - Slurred speech
 - Violent shivering
 - "I don't care attitude" - flattened effect
- Severe hypothermia** - core temperature 92°-86°F and below (immediately life threatening)
- Violent shivering occurs in waves, the pauses getting longer until shivering finally ceases - as the heat output from glycogenolysis in the muscles is not sufficient to counteract the continuously dropping core temperature, the body shuts down on shivering to conserve glucose
 - Person falls to the ground, can't walk, curls up into a fetal position to conserve heat
 - Muscle rigidity develops - because peripheral blood flow is reduced and due to lactic acid and CO₂ buildup in the muscles
 - Skin is pale
 - Pupils dilate
 - Bradycardia

Adapted from Nagpal & Sharma

Treatment of hypothermia centers on controlled rewarming in a safe and efficient manner. Without further cold insult, the shivering human body regains about 2 degrees C of core body temperature each hour. This requires a significant fuel load for energy consumption. Additional pearls of treatment include removing any wet clothing, replacing it with dry, weather appropriate clothing, the use if indirect sources of heat, if available, (up to and including other normothermic people, if necessary), the reduction of further heat loss (sometimes using a plastic layer to prevent same) as well as other more invasive measures. Multiple commercial products are available to assist the surgeon/emergency physician with active rewarming, including active body surface rewarming systems (ABSWS, e.g. Arctic Sun), forced air rewarming systems (e.g. the Bair Hugger) and endo/intravascular rewarming systems (e.g. Alsius and Coolguard).

Frotnip/Chilblains

Frotnip is akin to a partial thickness burn—a freezing of only the superficial layers of the skin. In most cases, the injury is reversible. The skin feels numb and appears white and waxy; deeper tissues remain soft and pliable. Rewarming should be accomplished gently without rubbing the affected body part as this can damage cells. Gentle rewarming can be accomplished by passive rewarming by placing the area against a warm body part or more active measures by immersing the affected area in warm feeling water (105°-110°F) for 20-40 minutes. Warm water should be added adjacent into the bath to maintain temperature rather than directly onto the affected area. Once rewarming is complete, a sterile or clean dressing is applied with the use of ointments to prevent dressing adherence to any developing superficial wounds.⁴

Chilblains is a superficial cold injury that occurs subsequent to prolonged and intermittent exposure to temperature just above freezing with high humidity and often high winds. Chilblains areas are initially pale, but with rewarming are red and often extremely pruritic. This commonly occurs in peripheral vascular beds like cheeks, ears, fingers and toes. Chilblains is often unpleasant but not harmful or serious, and further exposure to cold will cause recurrent symptoms. Some authors have advocated the use of oral nifedipine for symptom relief in more severe cases.⁵

Immersion / Trench Foot

Each of us has likely overstayed our time in the pool, emerged from the water and noticed “wrinkles” in hands and feet. This is the beginning of immersion injury, or “trench foot” and like Chilblains, is caused by repeated immersion in cool or cold water. Feet lose heat faster when they are wet and hence vasoconstriction occurs to prevent heat loss. This damages foot skin tissue from the buildup of toxins and inability to deliver nutrients/oxygen. The skin will look water-logged, then red/numb/itchy and ultimately progress to mottled and purple. Trench foot can become permanent when the vascular damage lasts more than 24 hours and has been a reported cause of foot amputations. Treatment remains simple, with ensuring the foot is dry and warm and allowing the injury to resolve. Additional damage has been reported by continuing to walk distances on an affected foot, and truly severe cases can take months to heal. As with all cold injuries, prevention is far more efficient than a course of treatment.

Frostbite

Frostbite represents the most severe of the soft-tissue cold injuries and is characterized by damage to all layers of the skin. Many classify frostbite similarly to other thermal injuries. Table III lists the varying degrees of frostbite and associated damage. Note, a patient with fourth-degree frostbite represents a clear limb threatening injury, and by virtue of most surgeon’s inexperience with these injuries, expert consultation should be sought.

Table III. Characteristics of frostbite by depth

- First Degree
 - Similar to superficial burns
 - Pain, hyperemia, mild itching and edema
 - Second Degree
 - Blistering and desquamation
 - Third Degree
 - Necrosis of skin and subcutaneous tissue
 - Often with clear ulceration
 - Fourth Degree
 - Destruction of connective tissue, bone
 - Often progresses to gangrene
-

Like other cold injuries, the treatment of frostbite begins with basic aid—protecting the patient from additional cold exposure by keeping warm, removing any wet clothing, and beginning rewarming. This must be done in a steady and measured manner. Additionally, if transport and definitive care is delayed such as in austere environments, rewarming should be delayed, and rewarming-refreezing often can cause worse damage to the affected area.

CARBON MONOXIDE POISONING: THE BASICS

An odorless, tasteless, colorless, and nonirritating gas formed from the products of incomplete hydrocarbon combustion, carbon monoxide (CO) poisoning is infrequently seen in warm climates but during Winter Storm Uri, many Texas centers saw increasing numbers of cases. CO preferentially binds hemoglobin with greater affinity (more than 240 times stronger) than oxygen, forming carboxy hemoglobin (COHb), thus displacing oxygen and causing impaired oxygen transport and delivery to cells. In addition, an intense inflammatory reaction results in lipid peroxidation that can have longer term sequelae.

While most cases of CO poisoning are fire-related, more than 50,000 ED visits annually can be attributable non-fire-related causes. Additionally, more than 1,200 deaths each year can be attributed to CO, with only 400 of these being unintentional, making CO one of the leading causes of poisoning in the United States.⁶ Interestingly, the mortality rate remains higher for those cases that are intentional when compared to those that are not. According to Clardy et al, "...potential sources of CO, other than fires, include poorly functioning heating systems, improperly vented fuel-burning devices (e.g., kerosene heaters, charcoal grills, camping stoves, gasoline-powered electrical generators, and motor vehicles operating in poorly ventilated areas)." Nonsmokers may have normal COHb levels of up to 3%, smokers 10-15%.

Ironically, Texas is one of six remaining states that lack a requirement for home carbon monoxide detectors. More than 1,400 Texans sought treatment in emergency departments during this winter storm for CO exposure. Of these, 72 percent were from areas that were predominantly African-American or Hispanic—far above the State's 57% share of the population.

TEXAS FROZE OVER: IMPACT ON HEALTHCARE SECTOR PREPAREDNESS

Winter Storm Uri affected all 254 counties in the State of Texas. Resulting power/water outages, icy roadways, and limited resources available affected nearly every healthcare system entity (only the El Paso market was relatively unaffected). By virtue of the above, several facilities struggled with the decision to

run life-saving equipment or continue to provide heating at the same time. Several lessons were learned in earnest by the healthcare sector and are worth mentioning here.

First, many of the federally funded healthcare coalitions (HCCs) in Texas provided critical response capabilities and allow insight into the preparedness lessons that must be learned. Response activities that were critical included: establishing filtered water distribution points, replenishing potable water in hospitals, nursing homes, and long-term acute care facilities, as well as several others. In addition, State of Texas' Emergency Medical Task Forces (EMTFs) were activated to utilize as rewarming sites and to alleviate an incredible surge in patients in Texas' emergency departments. As healthcare sector preparedness experts examine the long-term impact on preparedness, it will remain critical that in a single hospital system with more than 50 acute care locations in Texas, ALL of them reported an influx of weather affected patients seeking care. Additionally, this same healthcare system used de-identified HHS empower data to examine the total number of Medicare beneficiaries who rely on electricity-dependent durable medical equipment as a marker of surge demand.

As issues with power and water are well discussed above, perhaps the last and most important lesson learned during the winter storm with an impact on preparedness has to do with integrity of perhaps our most scarce and precious resource: human capital. At one point during the storm, more than 70% of Texas' acute care facilities were experiencing staffing shortages. This problem has become more acute in the ensuing months, as while the weather has improved markedly, the pandemic, contract staff drift, a tenuous marketplace, and increased demand leaves this as a problem that must be solved for future disaster planners.

CONCLUSIONS

Winter Storm Uri laid bare challenges to the healthcare system in the State of Texas by virtue of an isolated, unstable power grid lacking reliability, a plethora of cold injuries in a system unfamiliar with same, and preparedness challenges that persist well beyond the acute weather events. Medical disaster response experts across the country should continue to study this event to improve the response to future resource limited events.

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MEDICAL CHALLENGES OF LARGE REFUGEE RELOCATION: OPERATION ALLIED REFUGE

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BACKGROUND

Refugee resettlement is a highly complex process. Depending on the reason for relocation/resettlement (i.e. the refugee population and host nation's politics) there are many cultural, political, and medical/trauma systems lessons that should be learned. Additionally, the timeline for relocation and the ability to prepare the communities and medical system impacts not just the reception of the refugees but the ability to integrate, assimilate and provision medical care. All of these factors impact the dynamic situation and have lessons for the larger realm of migration medicine.

As more and more people are displaced by war, political strife, climate/environmental changes, and economic inequalities, the complex nature migration medicine effects the local and regional health care systems. Trauma surgeons, epidemiologists, local/regional politicians, social workers and infectious disease specialists all have to work in concert to develop the best system of medical care while taking into account the geopolitical situation, safety and basic needs of the refugee population. While the medical needs of migrating refugees can be challenging, especially in those with complex health needs, an un-fractured system of care is necessary for a continuum of care allowing for best practices and a performance improvement cycle in order to use data to make future informed decisions.

RAPID ESTABLISHMENT OF A VIABLE MEDICAL SYSTEM FOR LARGE POPULATION

1. A good system is a good system....and a good system takes care of people.
2. C2: Must have clear command and control. Leadership is a must at all levels.
3. Bad communication can be a single point of failure.
4. Ongoing capabilities assessments and addressing the point of need. Use data to inform best practices and for decision support.
5. Hub and spoke models can optimize capacity and medical capabilities.
6. Agile/Adaptive/Nimble → rigidity will break a system, but structure is imperative.
7. Anticipate problems and prepared package solution / deploying partial solutions is better than zero solutions.
8. For movements / long transports have en route medical capabilities.
9. Include security/safety procedures as part of the medical and evacuation plans...avoid making a challenging situation a bad situation.
10. Effective resource utilization / appropriation with continuous assessment.

OF HISTORICAL INTEREST

Give me your tired, your poor, your huddled masses yearning to breath free.

— President John F. Kennedy

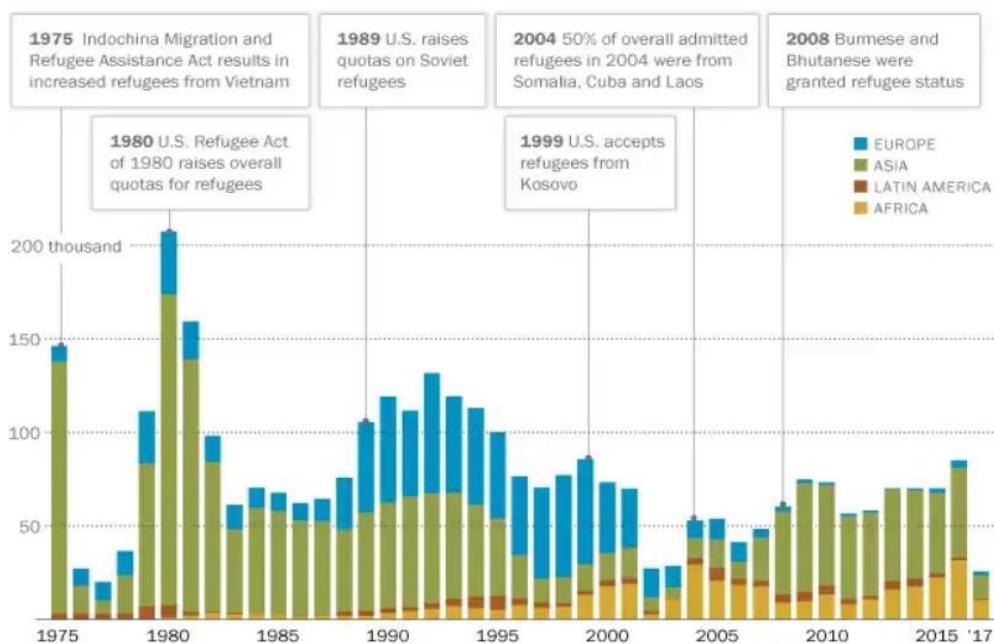
The United States is not new to refugee resettlement. Historically, waves of refugees have ebbed and flowed with global conflict and as populations get displaced. Modern waves of refugees arriving in the U.S. reached their peak in the 1980s in conjunction with President Carter signing the U.S. Refugee Act. This law raised overall refugee quotas and provided a provision to deal with special humanitarian concerns; health care for refugee populations has always been a challenge as there are different health concerns in migrant populations. Although there were massive waves of refugees coming to the U.S. in

the 1970s from Vietnam and Cambodia, well over 200,000 systems did not get indoctrinated to care for their unique health concerns. Many refugees from Vietnam suffered long term mental and physical health issues.

The U.S. Code and Refugee Act defines a refugee as any person outside of the U.S. that is of special humanitarian concern to the U.S. and “has a well-founded fear of persecution on account of race, religion, nationality, membership in a particular social group, or political opinion.” Refugees are different from asylum seekers, who meet the same definition but are already residing in

The shifting origins of refugees to the U.S. over time

Number of refugees admitted to the U.S., by region of origin of principal applicant and fiscal year



Source: Refugee Processing Center, 1975-2016.

Note: Data do not include special immigrant visas and certain humanitarian parole entrants. Does not include refugees admitted under the Private Sector Initiative. Europe includes former Soviet Union states. Asia includes Middle Eastern and North African countries. Africa includes sub-Saharan Africa, but also Sudan and South Sudan. Latin America includes Caribbean. Data for fiscal 2017 are through Dec. 31, 2016; fiscal 2017 began Oct. 1, 2016.

the U.S. or pursuing admission at a port of entry (like the U.S.-Mexican border), according to the U.S. Citizenship and Immigration Services.

In recent times, prior to the Afghanistan mass exodus, the ongoing conflict in Syria has displaced 12.5 million Syrians, from their homes, according to a Pew Research Center analysis of global refugee data. In fiscal 2016, 12,587 Syrian refugees were resettled in the U.S. This number was not massive and allowed for the gradual integration into the U.S. healthcare system. When large numbers of refugees arrive to the U.S. in a short period of time, the system is stressed and requirements for refugee camps develops. Starting in August 2021, large numbers of Afghans fled Kabul after Kabul fell to the Taliban and the U.S. left. The rapidity in which this occurred stressed every level of the system, especially the health care

system. Multi-agency efforts were quickly stood up in order to organize the reception of this huge population.

No one leaves home unless home is the mouth of a shark.
— Warsan Shire



Vietnamese and Afghan refugees flee their countries by boat and plane, respectively. The public health implications in both of these situations is predicated by: close quarters, communicable diseases, nutritional, social challenges, maternal and pediatric care issues, and the psychological stresses of fleeing their countries.

OPERATION ALLIES REFUGE

Operation Allies Refuge was a United States military operation that began in July 2021. The intent was to airlift certain at-risk Afghan civilians, particularly those who worked with the U.S. government such as interpreters, U.S. embassy employees, and other prospective Special Immigrant Visa (SIV) applicants. During the final days of the 20 year war in Afghanistan U.S. personnel also helped NATO and regional allies in their respective evacuation efforts from Hamid Karzai International Airport in Kabul. OAR was concurrent with the larger American military withdrawal from Afghanistan.

On August 15, 2021 Kabul fell to the Taliban and Afghan security forces fled the capital leaving it vulnerable to increased security threats. Massive numbers of Afghan civilians rushed to the Hamid Karzai International Airport (HKIA) and attempted to board military aircraft to flee Afghanistan. OAR became a massive airlift operation to evacuate as many Afghan SIV (Special Immigrant Visa) holders, embassy personnel, American nationals and Afghans that were seeking to flee secondary to fear of persecution or



personal safety. Multiple flights left in the subsequent days evacuating thousands of Afghans initially to the military base in Qatar. By the end of August over 30,000 Afghans had been evacuated. The site in Qatar was overcrowded and military bases in the U.S. prepared to receive evacuees. The initial sites in the States established were

Ft. Dix in New Jersey, Ft. McCoy in Wisconsin, Ft. Bliss in El Paso, and Ft. Lee in Virginia. While housing and living quarters were established at these bases, the medical response was unable to be sourced from the DoD. Military medical resources could not sustain this effort given they were already supporting multiple global contingency operations (including the military operation in Kabul) and national COVID relief. Medical care was provisioned by available military teams as well as contract organizations.

The bosom of America is open to receive not on the opulent and respectable stranger, but the oppressed and persecuted of all nations and religions.

— President George Washington

OPERATION ALLIES WELCOME

Operation Allies Welcome (OAW) began on August 29, 2021 when President Biden ordered the Department of Homeland Security (DHS) to continue OAR as the civilian lead agency. DHS was tasked to manage the resettlement of refugees and provide the sustainment of this operation within the U.S. DHS coordinated around the clock missions to screen Afghans prior to entry into the U.S. Once they arrived they were disposition to one of the eight military bases around the country. Ft. McCoy, Wisconsin and Ft. Bliss, Texas (large blue circles) each had holding capacities for >9000 Afghan refugees. Flights from Qatar or Afghanistan entered the U.S. through the international airports at Dulles or Philadelphia. It was here



where they were initially tested for COVID (or vaccinated), screened for medical issues and then moved along the established continuum to one of the military facilities. At the receiving facilities – full medical care was established, most of this being contracted care.

A holistic and comprehensive government approach was utilized throughout the OAW. Initially Department of State DOS) was assigned to be the lead federal agency. However, as the scope and total number of Afghan refugees continued to increase Department of Homeland Security (DHS) transitioned to the lead federal agency so DOS could focus on resettlement and immigration operations. Safe Havens were established on the U.S. military installations mentioned and depicted above. Multiple government agencies and non-government agencies (NGOs) came together to coordinate this massive humanitarian crisis resulting from the largest airlift of refugees in the history of the United States.

The DOD was assigned to oversee the establishment of medical care. The intent was for DOD to provision medical support and the medical portion of immigration physicals (see below). The medical activities were then going to transition to contracted medical care. Initially, prior the fall of Afghanistan to the Taliban and the mass exodus of Afghans from Kabul, Fort Lee was the only designated U.S. military installation/safe haven. Once it became apparent that the U.S. was going to have a humanitarian crisis on

its hands and that DOD medical support was no longer sufficient, additional military installations were stood up as safe havens and medical capabilities were contracted.

The following is a list of some of the medical challenges that were encountered. It is important to highlight that this is not the first time such a large refugee population has sought refuge after war, and it is unlikely going to be the last. Therefore, it is important that the medical community (as well as government agencies, NGOs, and local/national leaders) learned from the challenges of this most recent humanitarian crisis.

MEDICAL CHALLENGES

1. Triage and Regionalization— Just like in trauma, MASCAL, and any situation requiring the prioritization of care, the triage of the Afghan refugee population was no different. As thousands of individuals arrived at the receiving centers (Philadelphia and Dulles International Airports) they either moved on to one of the military installations or they were housed in local hotels or in large reception/receiving stations. With 5-7 out of 200 of refugees requiring some sort of immediate medical care upon arrival in the U.S., the requirement to establish on site triage and evacuation services quickly became evident. With a large range of injuries that require a diverse set of medical capabilities, having an effective triage system and having redundant/diverse medical capabilities throughout the evacuation system is important for effectiveness.

Many of the refugees were dehydrated coming off the plane. The requirement to establish on site triage and evacuation services quickly became a lesson that was rapidly learned. Having robust triage on site when refugees deplaned at each safe haven site help the medical team identify pregnant females as well as any easily identify medical issues that needed immediate attention and transport them to a civilian hospital.

With many Afghans recently involved in the conflict in Kabul, the diversity of required care was immense. While many required follow on care for management of external fixator or ballistic injuries, other refugees had significant co-morbidities, infectious diseases, pregnancies, etc. A robust triage at each safe haven ensures these individuals are identified and receive the best care possible. Despite the rapid coordination of medical assets to triage these patients – challenges with language barriers, cultural differences hindering communication, and fear of not getting care, regionalization and prioritization was a challenge. For example, many pregnant women arrived at Holloman Air Base in New Mexico. There was no OB capability present on the base. The contracted medical care was mostly GPs. The women who needed OB care – either to deliver or for prenatal management had to be transported off the base. Additionally, patients with untreated orthopedic injuries arrived at U.S. military installations that lacked surgical/orthopedic capabilities. Augmenting the receiving areas on the east coast with additional medical personnel. Regionalization of medical care and centralizing certain capabilities increases efficiency and prevents refugees with certain medial needs arriving at locations without those capabilities. Deploying more providers to the receiving airports in order to categorize individuals with health care needs ensures they are sent to the respective U.S. military installations that has the required capabilities. This early triage decreases the strain on the system and avoids delays in necessary medical care. While this may make it challenging for resettlement (ie all pregnant women and their families being sent to installations that readily had OB care available), it optimizes the health care system.

2. Communicable Diseases – The pre-existing living conditions, transportation crowding, and lack of routine vaccination in Afghanistan were ideal conditions for communicable disease transmission and outbreaks, including COVID-19. Afghanistan is ranked #7 in the world for measles and an outbreak in the U.S. would be detrimental to not only those newly infected but also to the Afghan

refugee's assimilation efforts. MMR vaccination was a huge priority at both the receiving centers (Philadelphia and Dulles Airports) as well as at the military installations.

Many women of childbearing age were amongst the refugees. Since the MMR vaccine is a live virus vaccine – pregnancy is a contraindication. Therefore sites needed to be set up to provide urine pregnancy tests prior to vaccine administration. This was similar for varicella vaccination. Maintaining documentation of vaccination status was also a priority.

Other vaccinations that were administered were the inactivated polio virus vaccine. Vaccinations were ideally given at the arrival sites to the U.S. But given the huge logistical challenge of this and the need to maintain throughput, vaccinations were frequently delayed until the OAW refugees arrived at one of the bases. Since they generally travelled in cohorts, the increased risk was balanced with keeping them at the receiving airports on the east coast.

COVID-19 vaccination occurred either at the airports or when they arrived to the military installation and were in-processing at the base. Keeping track of dosing and timing proved to be a challenge in the Afghan refugee population....but this was the case for U.S. citizens as well.

3. System Integration – Interagency cooperation and synchronization of communications, with clear command and control is necessary for such a large scale operation. While the DOD was responsible for the initial operation, OAR, DHS assumed responsibility as the lead agency for OAW. Ensuring clear communication and reporting is absolutely necessary for movement, medical care and site coordination. Daily reporting and dissemination of information is crucial to avoid working in silos and ensuring that problems that arise get addressed early. During both OAR and OAW comprehensive mission briefs with number of flights, number of refugees, medical testing, disposition, and many other variables were sent daily to all stakeholders.
4. Cultural considerations -- When dealing with a large refugee population, cultural differences must be considered. Afghan females and children (and their husbands and fathers) might not want male providers caring for them. Additionally, dietary restrictions must also be accounted for with contracted food services on the military installations.
5. Religious considerations -- Having appropriate areas to designate as places of worship and understanding religious and ceremonial customs will help a refugee population deal with the stress of leaving their home country usually under extreme circumstances. Given how many refugees suffer anxiety and depression, providing religious support is imperative for their overall wellbeing. Additionally grief counseling and support should be considered. Many individuals that relocate under such extreme circumstances such as those that occurred when the Taliban took over Afghanistan have suffered extreme losses of loved ones and have been persecuted themselves.
6. Mental health -- Anxiety and depression are common in refugee populations. Having behavioral health providers and areas of the safe havens and receiving centers helped the Afghan refugees deal with a variety of mental health challenges. Behavioral health providers with experience in trauma, as well as the ability to prescribe medications, was needed at each safe haven. Many of the Afghans were coming from extreme traumatic situations, additionally many were in touch with family still in Afghanistan and receiving graphic and violent videos of Taliban violence. Others had lost family members or could not contact their loved ones and feared for their family's safety. An NGO was able to send experienced trauma psychiatrists to each site in order to work with individual and groups. This team started a month and half into operations, they quickly identified were able to improve overall moral and wellbeing.
7. Translators/Linguists -- Male and female linguists that spoke the different Afghan dialects were necessary at each safe haven. Sufficient translators were a rate limiting step as well when it came to health care delivery. Lack of linguists increased wait times for non-urgent patients.

8. Orphan population -- Dozens of children arrived to the U.S. without their parents, this included infants. Setting up networks to potentially reunite children with their parents and also engaging social workers to help with finding orphaned children homes either with other Afghan refugees or in the community was a unique challenge. Engaging with orphanages, churches, mosques and other community organizations to facilitate adoption, physical and psychological care for orphaned refugees has to be considered in any humanitarian crisis.
9. Security -- Multiple security risks must be considered. Having such a large populations living on bases in relatively tight quarters posed a security risks. Additionally, given how politically charged the Afghanistan situation was, there was risk to the refugees when they left the bases. Education of receiving communities and positive cultural and educational campaigns can help mitigate some of these risk.
10. In addition to preparing the U.S. military installations/safe havens for living quarters, safety and sustainment (food, water, waste management, sanitation, etc) medical contracts had to be rapidly generated to support the requirements for medical care. Just like in disaster relief situations, there is a need for expeditious state licensing in order to execute the comprehensive contracts.
11. Contract medical care – Many of the military installation safe haven did not have medical services and the DOD was unable to provide enough teams to support this mission. The DOD had to rapidly establish medical contracts with civilian medial companies to provision full medical care for thousands of refugees. One of the challenges to expeditiously implementing contract medical care is the lack of national medical licensing. Just like in disaster relief operations, having a system that allows for swift medical licensing is imperative. All this happening amidst a global pandemic was an additional challenge in that medical capacities were already stretched this. Below outlines a partial list of requirements to establish medical care for a refugee population. It was determined that the contracted medical care would have to provide sufficient staffing, equipment and supplies to conduct three simultaneous medical lines of effort (LOE): 1) USCIS I-693 Immigration Medical Exam; 2) basic medical care and evacuation to a higher level of care if contract care support was exceed and 3) COVID Testing.

What follows is an example of the level of detail it takes to stand up a center for refugee care with provisioned or contracted medical capabilities.

USCIS I-693 Immigration Medical Exam

Care at the majority of safe havens had to provide supplies, equipment and personnel to conduct I-693 medical examinations to support on average of 250-500individuals daily. An **example** of the medical and non-medical personnel, as well as logistical support, needed for this level of throughput is as follows:

- 13x Physicians DO/MD & Mid-Level Providers
- 16x Medical Screener/Triage/COVID testers
- 4x Lab Technicians
- 12x General Purpose Support to include IT support
- 2x Public Health Nurse
- 5x Registered Nurse
- 4x Medical Admin
- 2x X-Ray Tech
- 10x Command and Control

- Other tasks:
- Occupy designated buildings or establish facility equipped with electricity, HVAC, lights, equipment, and supplies to conduct USCIS I-693 Immigration Medical exam
- Conduct transition with DOD medical units prior to taking over the mission
- Conduct rehearsal with DOS, CDC and NGO reps prior to assuming mission
- Provide daily required reports IAW specified guidance and designate Task Force requirements
- Provide equipment to include internet capabilities, Computers, and printers to support I -693 processing of 250-500 personnel a day (Areas PAD, Lab, X- RAY, Immunization's examination)
- All medical equipment should be FDA approved and have operational readiness rate/or availability over 90%
- Administrative: Provide administrative processing that are required IAW DOS, CDC DHS guidance
- Prepare I -693 Forms
- Print Labels prior to cohort arrival
- Manage patient flow to medical screening exam rooms
- Cohort schedule tracking/ coordination with NGOs
- Track patients/measure and throughput times
- Coordinate with DOS , NGOs to schedule appointments
- Coordinate with USCIS and customs for completion of I-693
- Maintain accountability throughout the I-693 process
- QC I-693 form
- Provide necessary printing, scanner, and copy capabilities throughout the entire I-693 medical process in order to print labels, labs, I 693 forms and all required parts of I-693. Maintain/provide supplies, and equipment.
- Electronically document IAW DOS standards, if not electronically documenting, then paper documents must be organized, secured and provided to DOS
- Laboratory: Provide lab processing as required IAW DOS, CDC DHS guidance
- Provide lab processing and any transportation to processing sites as required
- Coordinate with any off-site lab processing for the most efficient pick up and drop off times to assure fastest processing. Must ensure accessibility to military installation when military is no longer involved
- Process labs as rapidly as possible and no waiting for a certain number of labs to be completed prior to pick up
- Review lab results for communicable diseases and coordinate follow on treatment for positive results
- With a positive result from x-ray, blood work will be drawn for TB
- Labs required for I-693 screening (Contractor is expected to know what is required for each age as required by CDC) Expected with keep up with current guidance and regulations

- TB including sputum smears and cultures with drug susceptibility testing for persons with positive sputum cultures
- Quantiferon (IGRA test)
- Pregnancy test
- Syphilis screening
- Gonorrhea Screening
- Other disease of public health significance, Including Leprosy
- Immunizations: Provide immunization services that are required IAW DOS, CDC DHS guidance
- Procure and administer vaccines IAW I-693 requirements
- Provide capability to store required vaccines
- Track and administer 2nd dose of vaccines or any required boosters if personnel remain at the base for a long duration.
- XRAY: Provide x-ray services that are required IAW DOS, CDC DHS guidance
- Create interpret and provide final reading of x-rays
- Provide 4ea x-ray machines to ensure throughput of 250 guests a day. Plan to provide additional machines if and when processing throughput requirements increase
- All medical equipment should be FDA approved and have operational readiness rate/or availability over 90%.
- A biomedical equipment safety initial use and follow-on safety inspections and testing as required. Inspection / certification sticker visible on equipment.
- Baby scales are required due to the high rate of babies and births. The scale is required to ensure dosing of medication and vaccinations.

Basic Medical Care and Evacuation

- Provide Daily 24/7 routine sick call, primary care, and emergent care for all patient populations: pediatric , OBGYN, geriatric , etc
- Provide triage/ routine medical treatment for each arriving flight
- Provide trained physicians, physician assistants, nurse practitioners, nurses that can treat people from birth to geriatrics to include all genders and patients that may be pregnant
- Provide appropriate staff of at least 30% female (cultural considerations OBGYNs should be female) with the ability to build up to support personnel to support a 5000 refugee population for daily sick call demands.
- Male and female/children treatment areas must be separate and exam rooms need to have privacy. Medical privacy partitions will need to be supplied by the contractor.
- Reporting: provide new disease diagnoses and evacuation reports 2x daily to all agencies involved
- Coordinate with EMS to evacuate patients. Responsible for dispatching ambulance driver to the appropriate local hospital (The closest may not be the appropriate facility)

- Coordinate with HHS rep prior to evacuation to ensure patients have insurance card. If not conducted prior to evacuation coordinate with HHS rep when clinical situation permits
- Identify patients that have critical health concerns, report them to the USG representatives to expedite their processing
- Evacuation Services
- Provide 24/7 evacuation services to appropriate civilian hospitals. The EMS units will move all emergent and non-emergent patients from the sites to the next higher level of care.
- 24/7 mobile Translation services is required. These services must be able to transfer with the patient in the EMS unit to the higher level of care.
- Provide staffed and equipped ambulances to support population of 5000 at the camp and or evacuation requirements. At a minimum 2 ambulances must be on hand at camp/village site. As at risk population increases, respond with appropriate ambulances above the initial request to meet daily evacuation requirements/trends
- Laboratory Services
- Provide laboratory services in support of Role II with the ability to draw and process labs with most being resulted within 24-48 hours
- Pharmacy
- Stock commonly used pharmaceuticals for acute needs used during sick call and issue to patients upon discharge as required.
- Provide general pharmaceutical support and equipment
- Provide capability to prescribe medication package and dispense medication (Stocked pharmacy)
- Provide secured, cold storage for temperate controlled drugs
- Provide transportation to local pharmacy to pick up medications Radiology
- Provide 24/7 routine and acute care radiology
- Create interpret and provide final reading of x-rays and ultrasound images
- Provide X-ray machine ,Ultrasound machine or Doppler
- Provide Radiologist and Male and Female X-ray technicians Dental
- Provide emergency dental services with the ability to extract teeth, treat abscesses, and fillings and other routine emergencies
- Behavioral Health
- Provide routine behavioral health support and respond to BH emergencies
- Work with local hospitals upon patient discharge on treatment plan Force Health Protection/Public Health

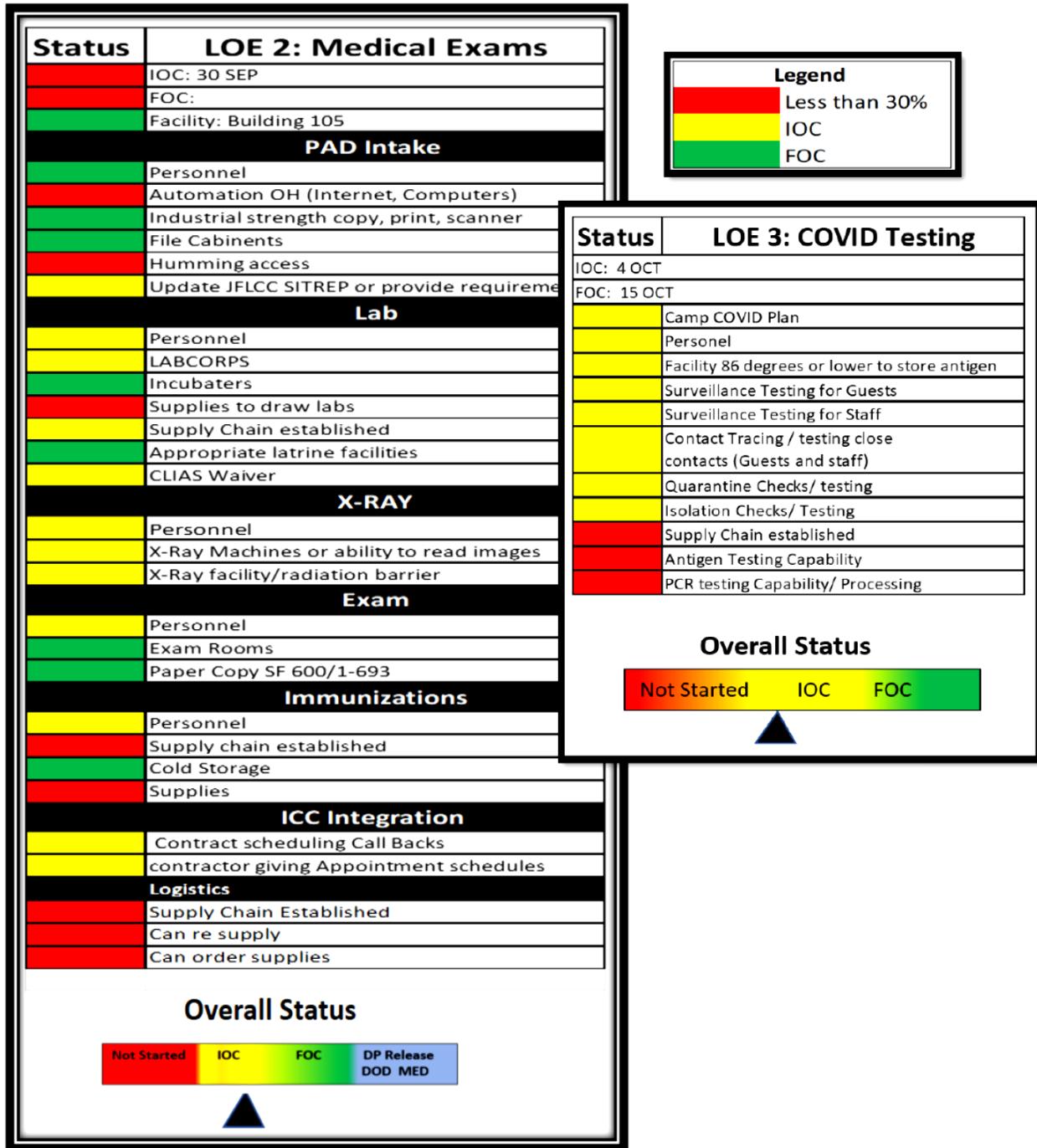
- Provide both clinical and Non-clinical preventive medicine/public health services: This includes “the surveillance, identification, prevention, and control of communicable diseases, illnesses, and injuries. Health threats include DNBI; environmental. They also include communicable diseases, arthropod-, vector-, food-, waste-, or water-borne. Preventative MED functions include risk communication, health education, field sanitation, medical surveillance, pest and vector control, disease risk assessment, environmental and occupational monitoring, medical countermeasures, proper waste (human, hazardous, and medical) disposal, food service sanitation, water portability, and hygiene.
- Conduct Food Inspections/ Certifications
- Assist with contact tracing if required
- DNBI surveillance
- Certification of water sources if required
- Basic pest management and surveillance Medical/Case Management
- Provide Case manager to Track patients
- Coordinate with evacuation services for patient pick up from local hospital
- Coordinate for follow up appointments Patient Administration
- Provide patient admin services that are required IAW DOS, CDC DHS guidance
- Provide clerical services to track patients, schedule appointments, maintain Patient Records and report DNBI Trends / Provide daily report
- Housekeeping - Provide medical facility cleaning (all medical sites), removal of trash, hazardous medical waste and regulated medical waste

COVID Testing

- Provide testing policy IAW DOS and DHS
- Daily tracking of COVID testing, test results, and persons in isolation and quarantine
- Reporting

Examples of checklists used for each of the above Lines of Effort (LOE)

| Status | LOE 1: Medical Treatment | | |
|--|--------------------------|--------------------------------|-------------------|
| | Arriving Flights | | Evac |
| Triage | | Personnel | |
| Evacuation | | Ambulances (4 og 6 ambulances) | |
| Role 1 | | Vans | |
| Personnel | | | Behavioral Health |
| Triage Locations | | Personnel | |
| Facilities | | Private Treatment Space | |
| Triage Established | | Dental | |
| Role 2 | | Personnel | |
| Personnel | | Equipment | |
| Facilities to include separate male/female Treatment Areas | | Force Health Protection | |
| Urgent/Emergent Care | | Personnel | |
| Acute Care | | Tracking Communicable Diseases | |
| OBGYN | | Surveillance | |
| Pediatrics | | Logistics | |
| Sick call | | Supply Chain Established | |
| X-Ray | | Can re supply | |
| Personnel | | Can order supplies | |
| X-Ray Machine | | | |
| Ability to interpret | | | |
| Lab | | | |
| Third Part Contractor | | | |
| Personnel | | | |
| CLIAS Certification Waiver | | | |
| Ability to process labs onsite | | | |
| Pharmacy | | | |
| Personnel | | | |
| Safe for controlled substances | | | |
| Supplies | | | |
| Dispense ability | | | |
| Coordinate with HHS for insurance Card | | | |
| Ordering MEDs at civilian pharmacies | | | |
| Dispensing off base medications to guests | | | |
| Case Management | | | |
| Personnel | | | |
| Integrated into processes | | | |
| Providing reports | | | |
| Coordinating with HHS, DOS DHS | | | |
| Linked in with local hospitals | | | |
| Dispatching ambulance to appropriate hospital | | | |
| PAD | | | |
| Personnel | | | |
| Reports (DNBI, EVAC) | | | |



SUMMARY

In July 2021, the U.S. began its final withdrawal from Afghanistan after nearly two decades of war. Several thousand US troops assisted with evacuation efforts as the security situation rapidly evolved. In mid-July, Operation Allies Refuge was announced to evacuate vulnerable Afghans and their families. A month later after the capital city of Afghanistan fell to the Taliban, there was a mass exodus of Afghans in the largest airlift evacuation in US history.

U.S. military planes evacuated tens of thousands of Afghans under precarious circumstances. The number of Afghans who fled their country resulted in a humanitarian crisis that required rapid planning and preparation for relocation.

The majority of large scale humanitarian and refugee operations have occurred overseas and not within the United States. After the Vietnam War there were close to 300,000 Vietnamese that sought refuge in the U.S. While there were likely similar challenges experienced with the provision of medical care, there are not many lessons learned documented from that experience. Principals from disaster relief planning can be used to inform preparation and implementation of large scale refugee operations. Factors such as triage, communication, security, regulated patient movement, integration of systems, interagency coordination, adaptability, planning and command/control can be used to optimize refugee operations. During OAR and OAW over 80,000 Afghans refugees arrived to the U.S. OAW was an operation run by

"Refugees are mothers, fathers, sisters, brothers, children, with the same hopes and ambitions as us—except that a twist of fate has bound their lives to a global refugee crisis on an unprecedented scale."

— Khaled Hosseini

DHS, with the DOD and DOS in support. The DOD ran the medical response at each of the military installation safe havens.

The rapid establishment of medical capabilities at each of the safe havens required flexibility, innovation, and was heavily reliant on contracted medical care. Lessons can be learned from these experiences to optimize medical care and the reception of a large number of refugees should future conflicts result in similar situations.

The author would like to acknowledge and thank MAJ Leah Steder, Joint Regional Medical Planner, US Army, who has worked tirelessly to improve the medical care for Afghan refugees and provided some of the information in this document.

SESSION 2

CASE MANAGEMENT: WHEN ALL PLANS FAIL

Moderator: Alison Wilson

Sunday, March 27, 2022

10:15 – 11:30 AM

Palace Ballroom 1-2

Palace Tower

Emperors Level - 4th Floor

Panelists: *Alexander L. Eastman*
 Jennifer M. Gurney
 Matthew J. Martin
 Chadwick P. Smith
 Dustin L. Smoot

SESSION 3

NEED TO KNOW BEFORE YOU GO

Moderator: Chadwick P. Smith

Sunday, March 27, 2022

11:30 – 12:30 PM

Palace Ballroom 1-2

Palace Tower

Emperors Level - 4th Floor

| | |
|----------------------|---|
| 11:30 - 11:45 | Tricks in my Took Kit - Five Things I Cannot Live Without Jay A. Johannigman |
| 11:45 - 12:00 | Advanced Resuscitative Care in the Field and ER: A Bridge Too Far? Zaffer A. Qasim |
| 12:00 - 12:15 | HICS Without Hiccups: Principles of an Effective Hospital Incident Command System Sydney J. Vail |
| 12:15 – 12:30 | Disaster Training Aboard the USS San Diego: An Extension of Hospital Facilities in Catastrophic Events Rachael A. Callcut |

TRICKS IN MY TOOK KIT - FIVE THINGS I CANNOT LIVE WITHOUT

Jay A. Johannigman, MD, FACS

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Good News! For years you have had an interest and the volunteer spirit to be available to respond with your skills to help in a humanitarian disaster relief effort. Now, finally, the call has come, and you have been selected to deploy in assistance to a third world country as part of a disaster assistance program.

The BAD News! You have 72 hours to be at the airport and ready to deploy.

This year Dr. Mattox has asked that I try to address the lessons learned by my colleagues in the military and Federal organizations that deploy on short notice. Most of us who have been privileged to deploy have learned a few tricks that are important, many that make things go smoother, and some that make the experience less stressful. I will outline a number of these tips in this syllabus and in the content of my presentation on Sunday.

PERSONAL PREPARATION

Deployment, whether to a military or civilian destination, is the best and the worst of all things. For me, each deployment has been a unique and very rewarding experience. You will be refreshed to find out the reasons you became a caregiver in the first place—to help others. At the same time, you will be faced with frustrations, inefficiencies, and challenges of providing a standard of medical care in anything but a standard situation.

Packing—you will be lugging your personal gear wherever you go—on and off cargo aircraft, into trucks and vans, in and out of tents, and wherever else the journey takes you. Bring those things you need—but you will be muttering under your breath if you overpack and regret that third pair of heavy shoes/books/etc. Find clothes that match the environment and can multi-task. I have had the same set of cargo pants for seven deployments. Find clothing that is quick to dry, pants that can zip off and convert to shorts, and lots of pockets with hardy zippers to keep things secure. Long sleeve shirts should be the basic; you will need the sleeves rolled down to protect from sun, critters and exposure. You can always roll up the sleeves, but you can't roll down a short sleeve shirt. Undershirts of Coolmax or equivalent are inexpensive and a must to help keep you working in any environment. A floppy or “Boonie cap” rolls up into a pocket and can be soaked in water to cool. One set of hiking (or combat boots from a surplus store—they are indestructible and well lagged for terrain); one set of running shoes for your sanity (if you run), and a pair of throw away clogs for the operating room—that you can hose down or pitch before you come home.

Sleeping bag—I have always slept either in, or on top of, my personal sleeping bag—an all-weather REI purchase twenty years ago. That way I don’t worry about sheets, critters or laundry. Find a bag that stuffs down to small size, is washable and lightweight—usually made for backpackers who value the same qualities.

Gorilla footlocker- these are invaluable. They cost less than forty dollars, are reasonably indestructible and multi-task very well. They pack your gear for the trip, sit in your tent as a secured storage unit and can be packed up and freight mailed back home to lighten the load. They also serve to store your personal gear at home between trips. Combine this footlocker with a backpack or backpacker frame (look on military web sites for a molle or tactical backpack—most are less than 200 dollars and will be with you on many other vacations and trips). The Molle backpack will stay with you on the plane and helps if you are delayed enroute. If you can't pack everything in these two items, you probably don't need it or won't use it.

Headlight- Buy two for personal use in and around the camp. They will get you to the latrine at night, serve as your reading lamp in the tent, and help you negotiate getting dressed in the morning without waking your tent mates. You may also want to consider spending a bit more on a personal surgical LED battery operated headlamp. Now that LED technology is widely available these surgical headlamps are lightweight, corded only to a battery unit, and provide generally acceptable operating conditions.

Leatherman tool (or similar) -An absolute must and you will wear it on your belt wherever you go. Leatherman had a contract with the DoD, so we are given one prior to deploying- but there are other brands that work equally well. Whichever you choose make sure it can function as a screwdriver, pliers, and multi-tool that will help fix all sorts of thing at the last minute.

Medical Texts - First let me recommend the Deployed Medicine App developed by the Committee on Tactical Combat Casualty Care and the Joint Trauma System (<https://deployedmedicine.com/>). This is a great app that contains all the Clinical Practice Guidelines for Joint Trauma system (hypotensive resuscitation, massive transfusion protocol, TBI management, wound care, fasciotomy, etc.) as well as the full recommendation and videos for teaching Tactical Combat Casualty care). You can download the pertinent protocols for your team prior to deploying so that you can access them without internet access. I still bring a few core texts—since I am a visual and hands on learner. These are the ASSET textbook, Dr. Mattox's Top Knife, and Netter's textbook of anatomy. They go into the footlocker and are worth their weight to me.

Loupes - Don't forget to pack them into the footlocker- you will need them. I have used them on every deployment. If you are worried about losing or breaking them, consider a less expensive version that provides magnification.

Your sanity -There will be lots of down time waiting for transportation, delays in movement, or simply times when things aren't busy. Consider how you are going to fill these blocks of time. For me it has been reading and music. Lightweight nano's, your own iPhone (if you can keep it charged), and headphones have kept me sane. I usually bring paperbacks but have also used a Kindle—No matter what your preference—plan on what you are going to do—or learn—or catch up on – because you are going to have down time. Make the most of it.

550 Cord and duct tape - Buy a roll of 100 feet of 550 cord (12 dollars on Amazon) and a roll of duct tape. If you can't fix it with 550 cord and duct tape—it is broken for good. You can rig your living quarters into a palace and make room dividers and black out shades with 550 cords and sheets. The little things count, and you will need to sleep when you can sleep. Make it as comfortable and private as possible. If you have 550 cord left over, you can always learn to make a deployment bracelet to remind you of the journey. Each knot a day or moment of time on the road.

MEDICAL GEAR

Keep it simple, durable, and light as possible. Remember, technology breaks readily under harsh conditions and is difficult to resupply. I recall being challenged by General Carlton to help develop the USAF's Mobile Field Surgical Team (Five members; one surgeon, one orthopod, one CRNA, one EM, and one tech). We were to be able to operate within one hour of being on site and sustain for ten days or ten operations until resupply. When asked what equipment we could bring the General responded, "Anything that you think you may need or use." Then, there was a long pause, and he smiled, "But remember, you are carrying it in on your back." We then had to pack and prove it would work by hiking in two miles to our test site at Camp Bullis. Lugging your own gear teaches you economy of scale. Statistics tell us that most of the surgical needs will be wound care and extremity surgery, where simple sets will suffice. Laparotomy will emphasize damage control and salvage surgery. Controlling hemorrhage, contamination, and damage control principles may be accomplished with a limited set of basic clamps, ties, and good lighting. We also would set up our trauma room with our deployment set on Friday nights (with a full set in the core) and start most trauma cases with the deployment set to teach ourselves what we had and how to conserve and operate in a constrained setting.

There may not be power to run instruments or recharge batteries. Drills and saws will need to be hand operated (and besides, powered instruments are incredibly heavy). Know how to use a Gigli saw, a Lebsche sternal knife, and a hand powered drill for burr holes and drilling. Staplers are great and relatively light but require lots of packing room for refills and cartridges. Remember how to hand sew, and use running sutures instead of pop-offs.

Gastrostomy tubes, if necessary, need to be large so that the family can feed their loved one with simple blended food. There will be no enteral supplements. Find local yogurt on the economy and mix it with any available protein source.

Most of what you will be doing is wound care, and remember that sterility is a nice concept but not a mandate. Meticulous wound care with clean dressings will save the day and will extend your capabilities. Bring an ample supply of liquid Chlorine. This will allow you to make Dakin's solution as well as purify your own water source.

How do you sterilize your surgical instruments? Our military teams carried Cidex powder, and we made fresh solution every 48 hours. Scrub the blood off then soak in Cidex and bet they are clean but not necessarily sterile. The bacteriologic burden of the instruments won't be worse than the environmental contamination your patients will be exposed to in your austere operating room.

IMAGING CONSIDERATION

Will you have X-ray imaging? Maybe not. CT scanning? Probably not. That is why I had to first learn Ultrasound and the USAF MFST surgeon's rucksack packed a Sono-site. It was a lot of weight and cube back then, but well worth it. Make sure you know how to do a thorough FAST exam, and learn to spot the lung sliding sign indicative of a pneumothorax. Preparing for this talk, I scanned the internet to educate myself about the most recent advances with respect to Ultrasound. There are an impressive array of devices that require only a lightweight US scanning probe that operates on internal/rechargeable battery. These probes are capable of multiple array(s) and a frequency range of 1-10 MHz They interface to your laptop or I-phone and appear to provide great images. Although not inexpensive, the majority are less than \$5,000 dollars and less than a new traditional unit. I plan to educate myself more on these options as the next ACS convention.

ADMINISTRATIVE CONSIDERATIONS

If this is going to have a chance of going well—bring the very best “can do” administrative person you know. Doesn’t matter how senior or junior they are—they just need to be ready to be creative, work hard, and be resourceful. He or she will be responsible for maintaining your ties to your sponsoring entity and/or the mother ship during the deployment. He/she will also be the jack of all trades (the equivalent of the Chief Master Sgt or SGT Major in the Air Force/Army). They will be responsible as your liaison to the local nationals, keeping you and families in touch, securing supplies and, overall, making the ship run so you and your team can focus on medicine. This person is probably the most important individual to the success of the mission, and make sure you and they understand this role. Choose this person wisely, make sure they have access to a credit card with a deep credit limit, and the support of your home agency.

Communication

Cell phones are nice but are usually the first piece of local infrastructure to fail or become overwhelmed in the setting of a natural disaster. A satellite phone is a must to assure communication back to the states and should be secured on a long-term basis if your home institution is serious about supporting your team.

Handheld communication devices (walkie-talkies) have always been the backbone for day in and day out communication when deployed. It is remarkable how accessible and affordable these devices have become over the last decade. A quick search on Amazon demonstrates that you can buy a set of ten handheld devices with a range of one to two miles for less than three hundred dollars. Each member of the team should have one to stay in touch when deployed. At this price, they are as essential as any other piece of equipment you will bring- and probably a lot more valuable.

Security

Own a gun? Know how to use it? You must give both questions some serious consideration. Personally speaking, one of the most uncomfortable aspects of my deployments is always having to wear a sidearm; often with a round loaded in the chamber (depending on threat status). I am not good with guns and still uncomfortable using them, although I am qualified before each deployment. It is easy for me when deployed because I am surrounded by soldiers who are trained and much better at handling weapons and defending our hospital and patients from any adversarial threat. The same may not be true for your team in a disaster response situation. I have also had the unfortunate experience of aiding in the evacuation of a civilian team member from Haiti when this individual was shot during a robbery of the team on their site. Assure that your team will be safe. This is not a time to assume that your team will be regarded as off limits to local bad guys. The idea is to provide great care AND bring everyone home safe and sound.

I am certain that there are many other things that could be considered prior to stepping on the plane to take you on that mission you have been waiting for. I hope that the list above will provide you a strong foundation and check list that will get you ready to go on short notice. Call your friends from the military or those that have deployed. You will find them a great resource and maybe even a resource to loan gear. Send me an email—happy to discuss and get you ready to go. Dr. Mattox is also a great resource and always answers his phone. We are here to help and thank you for your willingness to help those in need

ADVANCED RESUSCITATIVE CARE IN THE FIELD AND ER: A BRIDGE TOO FAR?

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SUMMARY POINTS

1. Hemorrhage, and particularly noncompressible torso hemorrhage (NCTH) remains a leading cause of potentially preventable prehospital death from trauma in the United States and globally. Interventions to reduce time from injury to hemorrhage control need to be emphasized
2. Despite multiple advances in in-hospital trauma care over 30 years, mortality rates for patients arriving in hemorrhagic shock (and/or requiring emergent trauma laparotomy) have not changed
3. The rate of potentially preventable death from non-compressible torso hemorrhage is likely higher than previously understood
4. Current US prehospital and trauma care systems deliver patients from injury to definitive hemorrhage control in a much longer time than the typical time to death from high-grade injury.
5. The current “scoop-and-run” approach may not always benefit this subset of trauma patients
6. Consideration should be made to adopting military and international civilian strategies of providing on-scene and en-route advanced trauma/critical care for this subset of patients.
7. This requires: needs assessment, team creation, advanced dispatch, continued training, quality assurance, system integration, and cost analysis
8. We are slowly integrating methods and techniques initially isolated to the OR, out to the ED, and now should be in the prehospital field for a subset of patients

THE NEED

Hemorrhage, and particularly noncompressible torso hemorrhage (NCTH) remains a leading cause of potentially preventable prehospital death from trauma in the United States and globally. Three decades of improvements in hospital definitive trauma care have shown substantial improvements in injury survival, but primarily benefit the patient if they reach the hospital in a state where they are able to be saved. A subset of severely injured patients either die in the field or develop irreversible hemorrhagic shock before they can receive hospital definitive care, resulting in poor outcomes.

There is a need for existing trauma systems to adopt a different strategy for this subgroup of patients for several reasons:

The proportion of potentially preventable prehospital and early (within 1 h) in-hospital death is likely higher than previously understood (typically >21% and as high as 45%), emphasizing the need to refocus care. Patients most likely to benefit from rapid intervention have NCTH (isolated or combined chest, abdominal, or pelvic hemorrhage) where prehospital interventions and resuscitation focused solely on extremity hemorrhage may not be sufficient.

Severity of injury and time from injury are inextricably linked to death from hemorrhage. High-grade NCTH deaths occur within 30 min of injury. An early peak of in-hospital death from hemorrhage occurs within the first 1 or 2 h. Based on multicenter study data from US trauma systems, the time from point-of-injury

to surgical hemorrhage control is a median 128 min. Thus in-hospital hemorrhage control for these patients is often being applied beyond the point of irreversible hemorrhagic shock.

WHY NOT STAY WITH “SCOOP AND RUN?”

Shortening EMS prehospital times (the “scoop-and-run” approach) is in our opinion one-dimensional, often not geographically possible in both rural and/or dense urban US locations (where for example in Houston and Los Angeles despite relatively short distances traffic congestion can hamper ground transport), and, outside of possible gain from using alternative transport methods such as the police in some regions, has not shown much benefit.

A multi-dimensional approach will consider specific injury patterns and a system’s needs, with consideration of moving advanced resuscitation and hemorrhage control near point-of-injury.

STRATEGY FOR US CAN BE SHAPED FROM MILITARY AND CIVILIAN LESSONS

Precedent exists for advancing prehospital care strategies and systems from both military and civilian forums.

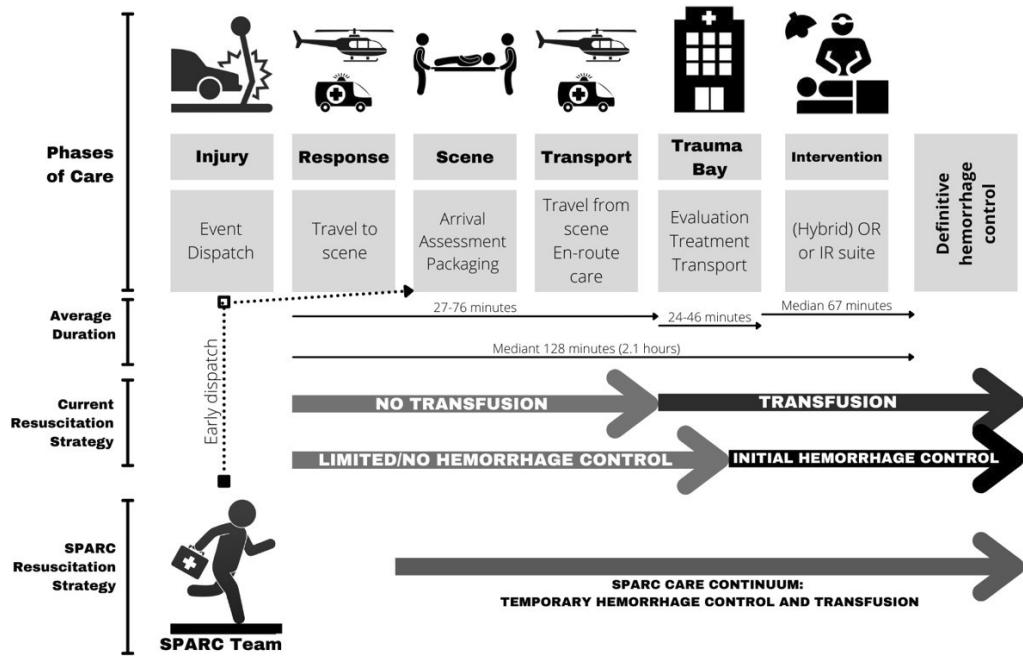
The military in 1996 adopted a set of best-practice guidelines termed Tactical Combat Casualty Care (TCCC), which shifted the emphasis of hemorrhage management from the hospital to the field and en-route. This led to a significant decrease in deaths from potentially preventable causes including extremity hemorrhage and tension pneumothoraces. The practice of prehospital tourniquet use and modifications to needle chest decompression have been adopted into civilian practice.

TCCC has subsequently recommended advanced resuscitative care, which is adding far-forward resuscitation of casualties with NCTH by using whole blood, with zone 1 resuscitative endovascular balloon occlusion of the aorta being utilized for non-responders

The one-dimensional “scoop and run” philosophy is challenged by the military’s capacity to deliver far-forward and en-route advanced critical care. The UK military’s Medical Emergency Response Team-Enhanced aeromedical platform is composed of a physician (from emergency medicine, critical care, or anesthesiology), nurse, and paramedic. This model utilized a Chinook helicopter to rapidly retrieve critically injured soldiers. The multidisciplinary clinical team provided en-route advanced resuscitation and hemorrhage control including but not limited to advanced airway management, chest decompression, tourniquet application, intravenous and intraosseous access, and blood product transfusion. Such advanced retrieval capability and en-route critical care most benefited casualties with high injury severity and has been implemented successfully by both Special Operations and Marine Corps units.

Precedent for civilian systems providing prehospital advanced resuscitation teams come from Europe, including London’s Air Ambulance (LAA) and the Paris Service d’Aide Medicale Urgente. Both physician-staffed services work in dense urban environments, play key roles in daily trauma care as well as during civilian mass-casualty incidents, and work within a supportive trauma system that has a robust governance structure. LAA utilizes its rotary-wing asset for rapid critical care team insertion (to overcome the ground transport time limitations in this densely populated city), who then provide on-scene and en-route advanced resuscitative interventions (including airway management, blood, and prehospital resuscitative endovascular balloon occlusion of the aorta) similar to the Medical Emergency Response Team-Enhanced model.

Developing Selective Prehospital Advanced Resuscitative Care (SPARC) teams within select trauma systems can allow the delivery of a robust “scoop-and-control” approach emphasizing early near POI advanced hemorrhage resuscitation and control while maintaining the momentum to transport to in-hospital operative care



IMPLEMENTATION

The following steps should be considered in implementation:

1. Needs assessment – the change must make sense based on local statistics. Autopsy data should be included in the needs assessment
2. Existing resources must be augmented, not replaced – bystander training, public-access bleeding kits, use of law enforcement are all mechanisms to capitalize on existing resources
3. Team composition – this should be dictated by the individual trauma system. Physician or non-physician teams (or a mix of both) can be utilized. A small crew number will allow higher volume exposure per team member and thus allow skill maintenance
4. Appropriate early triage – this is a crucial component. A limited resource should be allocated appropriately and in a timely manner. Dispatch centers can be consolidated to cover a larger area, with specific training and/or the presence of senior clinicians to help guide dispatch decisions
5. Integration with the trauma system
6. Ongoing training and quality assurance

POTENTIAL CHALLENGES

Success of such a strategy relies on system support and managing cost.

a. System Support

None of this is possible without system-level buy-in and administrative, logistical and financial support. This is complicated further by the current heterogeneous approach to US prehospital care within individual trauma systems. Significant differences can exist in systems that are adjacent to each, which makes a one-size-fits-all approach difficult for us to prescribe.

The proposed model echoes the recently described Minnesota mobile extracorporeal cardiopulmonary resuscitation consortium which saw significant benefits in out-of-hospital cardiac arrest (48, 49). EMS would appropriately identify patients in the field and transport them

to one of three hospitals where small, trained mobile ECMO teams would rendezvous, initiate extracorporeal cardiopulmonary resuscitation, and continue critical care management until the patient reached a central ECMO ICU. The consortium maintains regular team assessment of skills, and has been transparent in reporting outcomes. It is an example of how teams moved the needle for an entire community by obtaining buy-in between different health systems, EMS agencies, and city government to achieve markedly improved outcomes.

b. Cost Management

To augment existing trauma systems with SPARC teams, it is imperative to discuss potential cost implications. Financial implications affect both the agency providing the service as well as ultimately the patient. The Airline Deregulation Act has prevented the Department of Transportation regulating costs associated with air ambulance use in the United States, sometimes resulting in staggering costs to the patient, sometimes exceeding tens of thousands of dollars. This is often based on the typical configuration of air ambulance crews of a flight nurse and paramedic.

To add additional specialists such as physicians may lead this cost to increase. The exact additional cost is difficult to ascertain due to the vast disparity of billing practice and insurance reimbursement across the country.

Alternative models do exist. Some agencies are set up as charitable organizations relying on donations from the public to fund physician-level care without billing the patient. This is akin to several air ambulance charities in the United Kingdom. The Maryland State Police Aviation Command funds aeromedical patient care and transport through a small surcharge all Maryland residents pay when renewing their vehicle registration. Thus, the patient is not charged at the time their services are needed.

Finally, federal reimbursement may change as a new initiative termed the Emergency Triage, Treat, and Transport Model, is rolled out. This changes the reimbursement mandate from only prehospital transport to the actual quality of care delivered by prehospital personnel. Regardless, it is imperative for individual systems to factor specific cost (and factors to potentially mitigate this) into their decision to successfully implement a SPARC strategy, and whether the benefit to their population outweighs this additional expense.

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HICS WITHOUT HICCUPS: PRINCIPLES OF AN EFFECTIVE HOSPITAL INCIDENT COMMAND SYSTEM

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HOSPITAL INCIDENT COMMAND SYSTEM

HICS assists hospitals to improve their emergency management planning, response, and recovery capabilities for planned and unplanned events.

There is a saying that is attributed to several people including a music professor as well as military special operations forces personnel: '*amateurs practice until they can get it right; professionals practice until they can't get it wrong*'.

Whether it is producing the perfect notes to make incredible music every time it is performed or the perfect/seamless execution of complex military movements, it is the dedication to perfection that everyone is after, specifically, reproducible perfection. Why do hospitals, then, just do the occasional tabletop exercise or establish their ICS only for the occasional live drill or mock incident? Is this not a situation that requires key personnel to employ all practiced and prepared principles in order to improve the odds of a favorable outcome; we are only dealing with patient or staff lives, so is it okay to just go with the occasional practice scenario vs. continuous performance improvement and does it make a difference?

First, some background for those not familiar with the principles and practices of being a part of or the recipient of directions from a hospital incident command system (HICS). The initial information is about the National Incident Management System¹

The National Incident Management System (NIMS) guides all levels of government, nongovernmental organizations and the private sector to work together to prevent, protect against, mitigate, respond to and recover from incidents.

NIMS provides stakeholders across the whole community with the shared vocabulary, systems and processes to successfully deliver the capabilities described in the National Preparedness System. NIMS defines operational systems that guide how personnel work together during incidents.

How does NIMS relate to local incident command?

A basic premise of NIMS is that all incidents begin and end locally. NIMS does not take command away from State and local authorities. NIMS simply provides the framework to enhance the ability of responders, including the private sector and NGOs, to work together more effectively. The Federal Government supports State and local authorities when their resources are overwhelmed or anticipated to be overwhelmed. Federal departments and agencies respect

the sovereignty and responsibilities of local, tribal, and State governments while rendering assistance. The intention of the Federal Government in these situations is not to command the response, but rather to support the affected local, tribal, and/or State governments.

WHY IS ICS NEEDED?

When an incident requires response from multiple local emergency management and response agencies, effective cross-jurisdictional coordination using common processes and systems is critical. The Incident Command System (ICS) provides a flexible, yet standardized core mechanism for coordinated and collaborative incident management, whether for incidents where additional resources are required or are provided from different organizations within a single jurisdiction or outside the jurisdiction, or for complex incidents with national implications.

WHAT IS ICS DESIGNED TO DO?

The ICS is a widely applicable management system designed to enable effective, efficient incident management by integrating a combination of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure. ICS is a fundamental form of management established in a standard format, with the purpose of enabling incident managers to identify the key concerns associated with the incident—often under urgent conditions—without sacrificing attention to any component of the command system. It represents organizational "best practices" and, as an element of the Command and Management Component of NIMS, has become the standard for emergency management across the country. Designers of the system recognized early that ICS must be interdisciplinary and organizationally flexible to meet the following management challenges:

- Meet the needs of incidents of any kind or size.
- Allow personnel from a variety of agencies to meld rapidly into a common management structure.
- Provide logistical and administrative support to operational staff.
- Be cost effective by avoiding duplication of efforts.

ICS consists of procedures for controlling personnel, facilities, equipment, and communications. It is a system designed to be used or applied from the time an incident occurs until the requirement for management and operations no longer exists.

DEFINING THE INCIDENT COMMAND SYSTEM

The ICS provides guidance for how to organize assets to respond to an incident and processes to manage the response through its successive stages. All response assets are organized into five functional areas: **Command, Operations, Planning, Logistics, and Administration/Finance**. Figure 1 highlights the five functional areas of ICS and their primary responsibilities.

Figure 1. Incident Command System

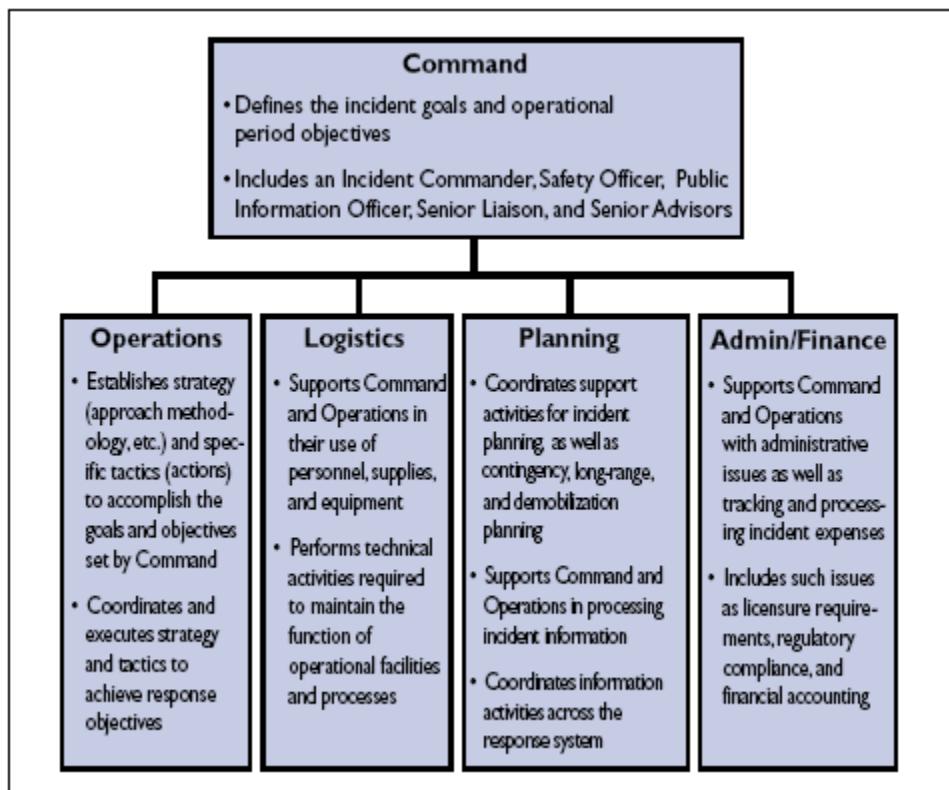


Figure 1 shows the Five functional areas of the ICS: Command, operations, logistics, planning, and admin/finance. The following are the primary responsibilities of each function area. Command defines the incident goals and operational period objectives and includes incident commander, safety officer, public information officer, senior liaison, and senior advisors. Operations establishes strategy or methodology and specific tactics or actions to accomplish the goals and objectives. Operations also coordinates and executes strategy and tactics to achieve response objectives. Logistics supports command and operations in their use of personnel, supplies, and equipment and performs technical activities required to maintain the function of operational facilities and processes. Planning coordinates support activities for incident planning as well as contingency, long-range, and demobilization planning. Planning also supports command and operations in processing incident information and coordinates the information activities across the response system. Finally, admin/finance supports command and operations with administrative issues as well as tracking and processing incident expenses. Admin/finance also covers such issues as licensure requirements, regulatory compliance, and financial accounting.

The ICS, as described in NIMS, refers to the combination of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure and designed to aid in the management of resources during incident response.

INITIATING YOUR HICS

(My Facility)

Valleywise reopens incident command in response to COVID-19 surge

POSTED AUG 12, 2021

PHOENIX (3TV/CBS 5) - Valleywise Health reactivated its incident command this week in response to an uptick in the number of patients hospitalized for COVID-19. Dr. Michael White, the chief clinical officer for Valleywise, said the move will help them marshal resources where they are needed most.

White said they still have beds available for patients, that their biggest problem right now is having enough staff to care for their patients. The move comes as the Arizona Department of Health Services reported the highest number of daily confirmed COVID-19 cases and the highest number of COVID-19 hospitalizations since February.

At this point, Valleywise doesn't need to take the more drastic actions taken during the peak of the pandemic, such as delaying elective surgeries and tests.

Valleywise reactivates incident command to manage COVID-19 crisis

POSTED NOV 13, 2020

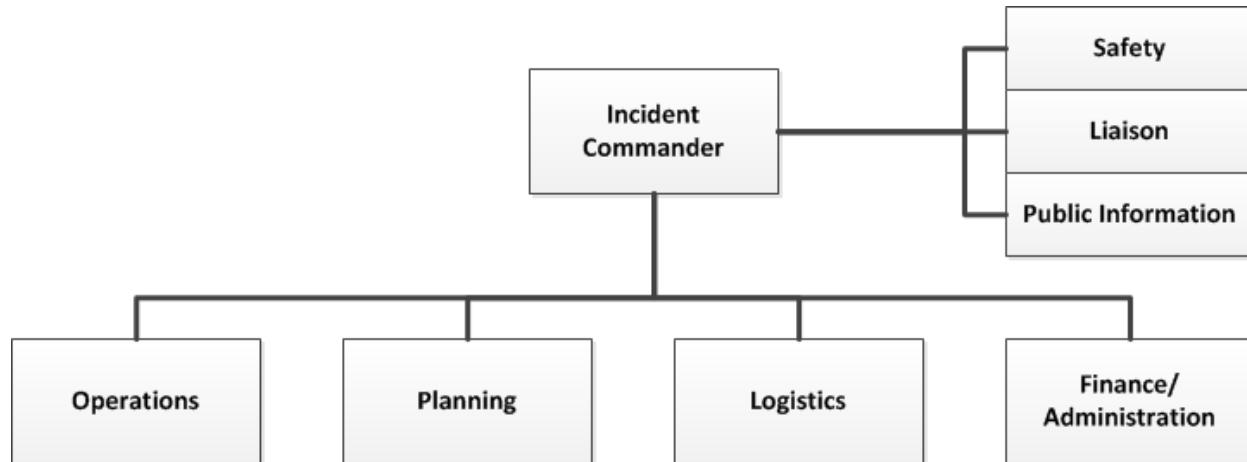
PHOENIX (3TV/CBS 5) -- Valleywise Health Medical Center reactivated its incident command Friday to help monitor hospital resources during the pandemic. As of Friday morning, Valleywise was caring for 32 people infected with COVID-19. "I would say over the last two weeks we've kind of gotten busier," says charge nurse Jennifer Granger. Granger works in what used to be the pediatric emergency department. It's now fitted with special equipment, converting each room into negative pressure rooms making the entire unit safer to treat COVID-19 patients. Three units in the hospital have been modified for COVID-19 patients.

The Valleywise incident command is described as a network of leaders monitoring factors like hospital capacity, levels of care, and PPE supplies.

Chief Medical Officer, Michael White, says the hospital stepped down incident command in late August, but with hospitalizations rising, they activated it again. We're starting to see an increase in the number day over day," says Dr. Michael White, Chief Medical Officer. White says staff learned important lessons during the last spike, which will help them handle a second surge. He says more is known about the virus and how it affects the body. Now healthcare workers are preparing for long days and the emotional toll of this deadly virus. "I'm ok with no breaks and any of that kind of stuff," says Granger. "But to have to tell a family member that their loved one's going to do and that they can't be present when that happens is, that's awful."

INCIDENT MANAGEMENT

Incident Command System



The Incident Command System (ICS) is used by public agencies to manage emergencies.

Not all of the ICS positions need to be active in each incident. The ICS structure is meant to expand and contract as the scope of the incident requires.

An abbreviated summary of the roles and responsibilities of each ICS position are presented below.

Incident Commander

- In charge of the organization's on-scene response
- Maintain command until public agencies arrive and assume command or when relieved at start of next operational period
- Assess the situation
- Order warning of persons at risk or potentially at risk to take appropriate protective actions
- Notify or verify internal teams, departments, public agencies, regulators, contractors and suppliers have been notified
- Appoint others to incident command positions as needed
- Brief staff on current organization and activities; assign tasks; schedule planning meeting
- Determine the incident objectives and strategy; identify information needed or required by others; ensure planning/strategy meetings are held and attend as needed
- Coordinate activities with the EOC; identify priorities and activities; provide impact assessment for business continuity, crisis communications and management
- Review requests for resources; confirm who has authority to approve procurement; approve all requests for resources as required
- Provide information to and coordinate with crisis communications or media relations team
- Terminate the response and demobilize resources when the situation has been stabilized

Safety

- Identify and assess hazardous situations; prevent accidents
- Prepare safety plan; ensure messages are communicated
- Stop unsafe acts; correct unsafe conditions

Liaison

- Point of contact with outside agencies and companies
- Monitors operations to identify inter-organizational problems

Public Information

- Notify spokespersons and Crisis Communications Team
- Develop information for use in media briefings
- Obtain Incident Commander and management approval for all news releases
- Conduct periodic media briefings
- Arrange for tours, interviews and or briefings
- Monitor and forward useful information to the media

Operations

- Manage all tactical operations during the incident
- Assist in the development of the operations portion of the Incident Action Plan
- Ensure safe tactical operations for all responders (in conjunction with any assigned Safety Officer)
- Request additional resources to support tactical operations
- Expedite appropriate changes in the operations portion of the Incident Action Plan
- Maintain close communication with the Incident Commander

Planning

- Conduct and facilitate planning meetings
- Supervise preparation of the Incident Action Plan
- Determine need for technical experts from within the company or outside as well as specialized resources to support the incident
- Coordinate with business continuity and senior management teams
- Assemble information on alternative strategies and plans
- Assess current and potential impacts on people, property, environment
- Compile and display incident status information

Logistics

1. Provides resources to stabilize the incident and support personnel, systems and equipment:
 - Workspace or facilities for incident management staff
 - Media briefing center
 - Transportation
 - Communications equipment
 - Food, water, shelter and medical care
2. Ensures Incident Command Post and other facilities have been established as needed
3. Assesses communications needs and facilitates communications between teams/personnel/agencies
4. Attends planning meetings; provides input to Incident Action Plan
5. Provides updates on resources (availability, response time, deployment)
6. Estimates and procures resources for the next operational period

Finance/Administration:

- Manages all financial aspects of the incident
- Provides financial and cost analysis information as requested
- Create accounts for claims and costs; coordinates with Logistics
- Tracks worker time and costs for materials and supplies
- Documents claims for damage, liability and injuries
- Notifies risk management/insurance to initiate claims reporting
- Provides incurred and forecasted costs at planning meetings
- Provides oversight of financial expenditures, new leases, contracts and assistance agreements to comply with corporate governance

EMERGENCY OPERATIONS CENTER

An emergency operations center (EOC) is a physical (e.g., a conference room) or virtual (e.g., telephone conference call) location designed to support emergency response, business continuity and crisis communications activities. Staff meets at the EOC to manage preparations for an impending event or manage the response to an ongoing incident.

***The emergency operations center should be activated whenever there is a major incident that causes significant property damage, potential or actual hospital functions disruption or has the potential to cause a significant impact on the hospital**

By gathering the decision makers together and supplying them with the most current information, better decisions can be made. A primary EOC should be established at the main hospital facility and a secondary EOC should be available at another facility, a temporary facility (such as a hotel) or through a teleconference bridge established to bring staff together virtually. The EOC supports the following incident management functions.

Activation -Bring knowledge and expertise together to deal with events that threaten the business

Situation Analysis -Gather information to determine what is happening and to identify potential impacts

Incident Briefing - Efficiently share information among team members

Incident Action Plan - Provide a single point for decision-making and decide on a course of action for the current situation

Resource Management - Provide a single point of contact to identify, procure and allocate resources

Incident Management -Monitor actions, capture event data and adjust strategies as needed

An EOC is not an on-scene incident command system - where the focus is on tactics to deal with the immediate situation. An EOC is used to support on-scene activities through the prioritization of activities and the allocation of available resources. A major function within the EOC is communications between the emergency response team, business continuity team, crisis communications team and hospital management.

HOSPITAL ICS SPECIFICS^{2,3}

Hospital Incident Command System (HICS) is an incident management system that is used by any hospital to manage threats, planned events, or emergency incidents. As a system, HICS is extremely useful, it guides the process for planning, building, and adapting that structure. Using HICS for every incident or planned event helps improve and master skills needed for large scale incidents.

Some hospitals have taken preparedness and readiness seriously. They train and exercise more than CMS or The Joint Commission requires which is twice a year for hospitals. All staff training on IS-100, IS-200, IS-700 & IS-800 from NIMS assists in a more global understanding and ability to execute/follow the principles and directions of your hospital's incident command system. On line course, table top exercises and live experiences will help coordinate all personnel to accomplish the goals and directions developed by the HICS for any and all incidents.

For all incidents or events the only required position is the Incident Commander. Usually the Administrator on Call (AOC) or the Shift/House Supervisor will be Incident Commander (IC) for any incident/event. The position can be initially and/or temporarily filled by a NIMS experienced person until the formally designated IC becomes present for the event. The IC adds staff positions as indicated or needed:

- medical/surgical technical specialist
- public information officer
- liaison officer
- safety officer
- operations section chief
- planning section chief
- logistics section chief
- finance/administration section chief

Remember that what comes down from the HICS should be followed. Discussions can occur with the specific liaison designated by each section chief or officer but they are seeing the big picture and typically those on the ground are engaged in a smaller part of the whole incident.

Back to my opening statement about practicing to get it right or as to not get it wrong. Hospitals are working leaner than previously, staff departures/turnover have made it difficult during these times to maintain the same level of readiness previously enjoyed. Budgetary constraints make for reduced 'practicing', staff stress potentially makes for less true 'all in' engagement. Hospitals must continue to remain engaged in HICS readiness and prepared for the next large scale event. Creative means to maintain staff and physician engagement is paramount and could determine the outcomes of an event that we all need to take responsibility for. These are our communities, neighbors, and families so it is certainly worth the investment to be as prepared as possible; practice and prepare for the events as though our hospitals knew we were responsible for caring for our own. We are professionals always trying to make it so that we can't get it wrong, not just doing it so that we get it right.

Please refer to the websites listed in the bibliography which I thought contributed the most to this presentation and to a solid foundation of understanding and seek out other references so that you are doing your part in education and preparedness. You may be asked to participate in the HICS EOC and we all want the best, most appropriate people in these positions.

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DISASTER TRAINING ABOARD THE USS SAN DIEGO: AN EXTENSION OF HOSPITAL FACILITIES IN CATASTROPHIC EVENTS

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In October 2016, the City of San Francisco, the area Level I trauma center, Zuckerberg San Francisco General Hospital, and the Navy embarked on a unique regional civilian-military disaster training exchange program. The exercise was a multiday event over the annual San Francisco Fleet Week activities. The program has led to a continued partnership for the last 5 years between the City of San Francisco and the Navy in preparing for the next “big” disaster.

San Francisco is a city that has experienced a multitude of moderate to large disaster events, including several large earthquakes, including the 1906 and 1989 ones. There have also been several mass shooting events, including the 2017 UPS headquarters shootings, the You-tube headquarters shooting in 2018, and the crash of Asiana Flight 214, a Boeing 777 carrying 307 people on Saturday, July 6th, 2013. The region has also experienced its share of natural disasters, including the Napa Earthquake in 2014 when an estimated \$1 billion dollars of destruction occurred and over 200 people were injured. The region has also seen mass destruction and loss of life due to a number of large wildfires over the last several years, including the 2018 regional fire that killed 85 people and damaged 18,000 homes in the community of Paradise.

These events have highlighted the tremendous skill of the region’s healthcare systems, but also drawn attention to the vulnerabilities created by a densely populated region with a comparable small trauma system to care for mass casualty events. This has created interest and need for robust regional disaster planning. The Northern California region is considered one of the 11 Megaregions of the United States. According to the Bay Area Council Economic Institute, the annual rate of gross regional product (GRP) growth has been greater than 5% every year since 2010. This places the megaregion as the area with the highest gross domestic product (GDP) in the country.

With the economic growth comes the associated concern of crafting regional response systems that can provide care to this substantial population spread over a large geographic area. The Megaregion includes 21 counties separated into 4 smaller regions: Bay Area, Sacramento Area, Northern San Joaquin Valley, and Monterey Bay Area. The region has an estimated population in excess of 12 million persons and accounts for more than 31% of the entire state population of California. In this Megaregion, there are just 6 American College of Surgeon Level I adult trauma centers including Zuckerberg San Francisco General Hospital (SFGH), University of California Davis in Sacramento, Community Regional Medical Center in Fresno, Highland Hospital (UC East Bay), Stanford Health Care, and Santa Clara Valley Medical Center (San Jose). Two of the 4 regions of the Megaregion have no Level I trauma center.

Although 4.7 million people are in the immediate San Francisco – Oakland – Berkeley area, only 2 Level I centers exist in that area. Geography also plays a really important role in planning. Many of the trauma centers are geographically restricted. For example, the City of San Francisco with a population of 1 million,

has a single trauma center of any level, and the nearest trauma center is several counties away. Others require crossing bridges which could be disrupted in many disaster scenarios including earthquakes. The area trauma center also does not have helicopter medivac capabilities.

This creates special consideration in response to disaster planning. The opportunity to partner civilian disaster planning with military expertise allows a priceless exchange of knowledge. Our experience from these activities highlights a number of non-traditional considerations in hospital disaster response and provides a framework to build improved institutional disaster response plans.

THE EXERCISE OVERVIEW

Over the first week of October 2016, a team of civilian medical personnel, including trauma surgeons, emergency medicine physicians, anesthesiologists, nurses, prehospital providers, and City/County Disaster Planning personnel participated in an exchange program with members of the US Navy's 3rd fleet from the USS San Diego (LDP-22). Additionally, the Marine Medical Corps participated.

The first portion of the exercise involved simulation exercises of medical evacuation from civilian areas using military transportation. The next portion involved an overnight exchange program where 6 civilian providers were transported on military helicopters to the USS San Diego, which was at sea off the coast of Northern California. The goal of the exercise on the USS San Diego was multipronged, with an overarching focus to practice the use of the Navy ship as a medical base of operations to support civilian – military combined disaster response. The six representatives, including Rachael Callcut, a trauma surgeon; Malina Singh, an emergency medicine physician; Benn Lancman, an anesthesiologist; Craig Johnston, chief of California's Disaster Medical Services Division; and Arom Bronston, the prehospital coordinator for the City/County of San Francisco Department of Emergency Management. **The wide representation of prospective was a key learning from the exercise.**

After a two-day experience on the USS San Diego, the team sailed into the SF Bay Area as part of Fleet Week. This was followed by a day long program of the military colleagues touring the facilities of the SFGH Trauma Center. The teams also assembled their land operations on site to highlight expansion capabilities and to extend the information exchange. The group also set up operations near the Fleet Week exercises to serve as an additional mock staging area. Finally, there was a scientific conference where ideas and lessons learned were shared with regional agencies.

Detailed Hands-On Exercise

For all of the civilians selected, we intentionally chose those with no to little prior military exposure. We gathered on the tarmac of the San Francisco International Airport to begin the field rescue of an injured (simulated) patient. A MH-60S Sea Hawk helicopter approached for landing as we tended to our patient at the scene. The “patient” was complete in moulage with realistic abdominal wounds, bandages, and in full character. **The ability to create a realistic scenario and drill that scenario complete with patients helped to elucidate the opportunities and challenges in partnering on disaster response.**

Standing on that tarmac, I reflected back to what the scene would have been like in 2013 with the Asiana 214 crash on that same air field. I had triaged the hospital side of disaster response 3 years prior and being at the ‘scene’ was surreal for me. I was an experienced and skilled trauma surgeon in my own environment of the hospital, but on that tarmac I immediately recognized how challenging coordinating evacuation would be. For starters, this was an active run-way. Although we were kept safe during our exercise, there were planes taking off, taxiing, and landing in proximity to us. We began to assemble in real time a list of all of the factors we would have to plan for if our airport was used as a staging scene. **Considering scene characteristics and strengths is vital in optimizing disaster response.**

We went to work on our patient. It was time to start the drill. We were focused on stabilization, field evacuation principles, and our team worked well together. But, we knew each other and worked together in our everyday roles. As the Sea Hawk helicopter landed, two more important points struck me. We were about to enter an unfamiliar environment and would need to assess quickly how to most effectively blend our teams. **Each of us would have to rapidly adapt including facing fears we had or discomfort with the unknowns.** In fact, one of our participants that was to fly on the MH-60S Sea Hawk helicopter suddenly disclosed they were 'deathly afraid of flying.'

I had previously flown on civilian medical evacuation helicopters, but even for me, loading our patient onto the helicopter and climbing into this new environment was initially intimidating. Our military partners quickly loaded us, helped us with our helmets and safety gear, and assured each of us that our harnesses were securely in place. Lifting off from the air field we took the same route that we would utilize if this were a real evacuation.

Flying over the city nearing the Golden Gate Bridge, I had a moment to consider time. In trauma care, time is our foe. Even as smooth as this evacuation was, **time would not be on our side in a real disaster.** To be effective, we would have to determine who would be the right patient to take a distance to a ship anchored at sea. Another important lesson. That decision would clearly be influenced by the type of disaster, the condition of our own civilian facilities, and logistics of moving patients.

Mass casualty events (MCEs) certainly would not have immediate availability of a military partner in most scenarios as it would take time for the military to respond and move resources into place. **Any time you are afforded to prepare prior to the MCE arrival use wisely.** As soon as notification of the MCE is verified, plans should be enacted in the local centers to clear space in the Emergency Department, ICU, and floor for potential patients. I quickly realized that for some period of time, the local civilian system would need to initially stabilize the injured as the military ramped up response.

Practical considerations such as documentation of patient care would even need addressed. Typically, military and civilian groups tend to use different reporting systems. Standardization of medical history documentation would be useful if we were to collaborate. As we approached the ship, 4 miles out to sea, it became clear that wind could be an issue in moving patients. All information that moved with the patient would need affixed to something. Civilian triage tags, papers with their history, and other non-secured items could easily be lost.

As we touched down on the 684-foot-long USS San Diego far from land in the Pacific Ocean, I observed everything I could. I noted how the teams worked seamlessly together, how efficient they were, and how precise they were in moving the patient safely to the medical facilities inside the ship. **Every person on the team knew their role and was empowered to carry it out.** In civilian disaster planning, we often ask personnel to take on expansion of their normal roles or use them in differing capacities. In a real scenario, you will have to assess not only the number of personnel you have, but also the skillsets they possess. Give people roles they are capable of. **Most people can expand beyond their comfort zone a bit, but if they go too far, they become ineffective.**

The Navy team was ready and prepared for the injured patient. They skillfully moved the patient through narrow stairwells using specially designed equipment. **We also cataloged the difference between civilian and military equipment such as stretchers for moving patients.** The Navy team proceeded to a fully functional operative suite where they performed a mock operative procedure. **Having a good communication plan in advance was vital.** For a civilian response, we would need to establish how to mobilize the civilian team, where they would gather, how they would be deployed, and what duties would they do. For the military participants, we would need similar plans and determine how we would communicate if they were dispatched into our civilian hospitals.

Communication is always one of the most important components of successful disaster responses. We shared that for prior disasters we had each department organized themselves with a plan that worked for them with the resources available during our event. We had learned that no one size fits all plan works. It may be best to keep all personnel who responded in a central location out of the way and integrated them as needed into active patient care. In other cases, gathering in smaller groups throughout the civilian center may be more optimum. However, there has to be a communication plan developed in advance that is widely known.

Over the next two-day period of time, we were shown the inner workings of the USS San Diego medical capabilities. The team drilled simulated additional simulated scenarios together, drafted initial plans of how the medical facilities could be utilized in a disaster scenario, and worked through logistic plans of moving patients from the land-based operations to sea-based operations. We observed mock trauma responses on the ship which closely resembled those of the civilian centers. We debriefed in lengthy discussions and recognized as one of Navy Captains summarized “**we have a common bond... but, we have different capabilities.**” Identifying what each group could provide, where the strengths resided, and the gaps helped to facilitate longer term planning.

Thinking outside the box with an open mind about what was possible was perhaps the most valuable part of this exercise. As we learned about all the roles on the ship, the walking blood bank, the ship terminology, experienced the sleeping quarters, ate side by side with the crew, it became clear that we had just scratched the surface of the profound opportunities that exist to maximize civilian-military partnerships. **Situation awareness would be paramount for successful responses in real scenarios.** As such, we proceeded to host the military partners at our center to share the capabilities and operational aspects of our center.

This value and challenges of civilian-military collaborations have had heightened interest as the number of mass casualty events, both natural disasters and human made events, have grown in recent years. Our findings were consistent with what has been described in the limited literature that exists. Full scale simulation exercises like the USS San Diego – ZSFGH event have been identified as vital in addressing barriers in advance of a large-scale disaster. A successful collaboration requires not just a full understanding of the medical capabilities, but also addressing the lengthy list of non-medical capabilities that would need harmonized across the multidisciplinary group. Planning, infrastructure, knowledge, and cataloging resources have been identified as the major components of being adequately prepared. These are hard to fully assess without drill exercises. The opportunity to stress the systems in place provides invaluable insight into optimizing disaster response capabilities.

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SESSION 4

LUNCHEON SESSION

Moderator: Kenneth L. Mattox

Sunday, March 27, 2022

12:30 – 2:00 PM

Palace Ballroom 1-2

Palace Tower

Emperors Level - 4th Floor

Mass Casualty Management: Basic Principles and Pitfalls – Is Your Hospital Ready?

Jayson Aydelotte, MD, FACS

Associate Professor of Surgery

Dell Medical School

The University of Texas at Austin

Austin, TX

MASS CASUALTY MANAGEMENT: BASIC PRINCIPLES AND PITFALLS - IS YOUR HOSPITAL READY?

Jayson Aydelotte, MD, FACS

Associate Professor of Surgery
Dell Medical School
The University of Texas at Austin
Austin, TX

Mass Casualty (MASCAL) Management is, for most of us, a nebulous concept. Many of us never get to be a part of an actual mass casualty, and if we do it, is almost always a singular, confusing-if-not-terrifying event. Preparedness for such events consists mainly of non-surgeons dreaming up scenarios for which they hire moulaged patients to pretend to be injured and then railing them through the busy emergency department on a busy Tuesday morning where most of the disinterested caregivers assigned to play simply pretend to care for the pretend-injured. This was my preparedness experience for every year of my residency and fellowship.

And then I got deployed to the Green Zone in Baghdad, Iraq, in 2007 during the so-called Surge.

None of those play-dates prepared me for real-world mass casualty management. But over the course of my time, there we saw so many MASCAL events that we actually got good at creating systems and avoiding pitfalls that make the terrifying bearable and even efficient.

It is important to know the physical situation of the hospital in the Green Zone to better understand how this relates to many of you. Unlike movies or other deployment hospital situations, the hospital in the Green Zone was a hard building, 1980's vintage, three story structure. There were three operating rooms, two of which had two operating tables (so five beds total,), a fast CT Scanner, top of the line ventilators, all the blood products (for the most part) you could want, and two separate Emergency Department rooms one holding three beds and the other eight beds. It was not an austere tent hospital. It was very similar to the "old" hospitals many of you worked in before you got your shiny new 2009 to 2018 version you currently work in. If you've ever been to Austin it was much like old Brack. For the most part, it moved and behaved like a modern hospital in which many of you currently work.

What follows are the principles we developed to fine tune our system.

SETTING THE STAGE

MASCAL has many definitions. The most popular, for which I have a gutteral dislike, is *an event where the casualty numbers overwhelm the system's resources*. This isn't a very helpful definition because it already sets up a mindset of *being overwhelmed*, which is a defeatist lens through which productive efficiency is clouded. A better definition would be *a group of casualties that outnumber your ability to treat all of them with the space and personnel immediately available*. While this seems a similar definition, it isn't. It recognizes a relatively large number of casualties but also recognizes the beginning point in time. This definition accounts for a solution so as to *not* become overwhelmed. These patients must MOVE through the SPACE you have with the PERSONNEL available to you. This philosophy is the bedrock of effective MASCAL management.

The scenario that we will use for what follows is a major explosion event at a sporting event. The assumption is many hundreds dead, many thousands injured, and one hundred casualties coming to your

Level I trauma center in the next hour. This is a reasonable number of casualties if someone ever gets explosives near a stadium.

HOSPITAL MISSION

My hospital's usual everyday mission reads: *Our mission inspires us to care for and improve the health of those we serve with a special concern for the poor and vulnerable.* And that's what we do. Our whole system of care is built around that mission. Not only do we care for the injured, we care for everyone who can make their way to our emergency department, many of whom have some form of chronic problem.

But when a MASCAL happens your hospital *must* change its mission. There's simply not going to be room or energy or people to care for everyone when a hundred people are going to hit the door in the next hour and hundreds more over the rest of the day. The hospital must change its mission to be focused on this event. This mission change is essential to safe and efficient movement through the hospital. Your new mission statement should be some version of: *To mitigate death and suffering for ALL the patients that enter the building.*

This change in mission statement is essential. It gets everyone on the same page, from nurses to supply chain people to pharmacy. Many concepts of safety and autonomy will be challenged during this time and if the hospital's mission is clear and EVERYONE is on board, the MASCAL can be run in a way that accomplishes the hospital's mission.

Getting your hospital to agree to a mission change during a MASCAL is the first step to developing a good plan. If they don't, the concept of patient movement as described below will be very difficult, if not impossible, to accomplish.

MOVEMENT, SPACE, AND PERSONNEL

The basic principles of MASCAL management are to MOVE through the SPACE you have with the PERSONNEL available to you. While this seems very simply in concept there are a few basic things to recognize about each of these pieces to make your preparation and execution more effective.

Movement

Normal patient movement in a hospital goes something like this: a patient is involved in a car crash and after a thorough workup is found to have a femur fracture and a head injury which was severe enough to get intubated but not require an operation. He needs to go to the ICU. Under *Normal* movement philosophy the decision to admit to the ICU takes about six minutes from hitting the door to getting intubated. He then leaves the trauma bay and heads to the scanner where his head injury is identified as is his lack of need of an operation to fix it. On a slow night from admission to leaving the trauma bay to the scanner would take 15 minutes. Now the room is empty.

But usually the patient goes back to the trauma bay or occupies another room in the ED while something akin to this process happens: Doctor tells bedside nurse patient needs to go to the ICU. Bedside nurse at some point tells ED charge nurse of this request. ED charge nurse tells the Bed Coordinator (or whatever your hospital calls this person) about the request who promptly calls the ICU charge nurse. The ICU charge nurse looks over his roster and identifies 222 as potentially available so long as he can find the appropriate staffing which he will do his best to put together in the next short while. About an hour goes by during which the ER bedside nurse gets anxious and calls the charge nurse who calls the bed coordinator who calls the ICU charge nurse to ask what's happening. The ICU charge nurse then says *okay, yes, 222 is ready.* The bed coordinator then calls the ED charge nurse back who lets the bedside nurse know. The

bedside nurse then picks up the phone and calls the nurse slated to care for 222 and gives report. She then tidys the patient up and brings him upstairs.

At most places you are lucky if this takes less than 2 hours.

But the only thing that *actually needed* to happen in this scenario was the nurse pushing the patient to the ICU. All the calling and checking is, in its basic most fundamental concept, unnecessary.

All that is *really* necessary in this situation is knowing what physical space in the ICU is available. During a MASCAL event, nurse staffing ratios, etc. go out the window. Everyone pulls up their bootstraps and makes it happen. It's the cornerstone of efficient movement and making room in the ED for incoming casualties. This is how it worked in the Green Zone, and despite all the fear that nurses would spontaneously combust or patients would linger and die in the ICU without adequate care...it never happened. Patients did just fine. It's amazing what smart people can do when they are free to act with their own brain and under a singular mission.

This movement philosophy, *pop the brakes and roll to the ICU without any phone calls anytime*, creates the most liberating practice environment. It also multiplies the beds in the ED...

Space

Space is relative. It's actually should be conceptualized as available space in time. A trauma space-time continuum.

For the sake of argument and to set the stage for this scenario, lets say we are in an ED that has 5 resuscitation bays and 20 other ED beds. Under a *normal* movement philosophy, you can move 25 patients through the ED in a given two hour period. But if you commit to a new mission and change your movement philosophy, you can turn each of those rooms over in ten minutes. Patient comes in; gets evaluated. Procedures are done or not, and the patient is going to leave. He is going to go to the OR, to the ICU, or to the ward. Simply go. If you practice efficient ATLS protocols, most of these decisions can be made in about six minutes, and the patient is ready for movement in another three minutes. Once they are gone, the room is now open for another casualty. Let's say it takes another two minutes to move another gurney into the room. You can effectively now move five patients per room per hour. Now your ED can move 125 patients per hour!

The key to this concept is committing to a mission and committing to a new philosophy of patient movement. If you don't, you will be stuck with zero open beds and stacks of casualties mounting outside.

Personnel

As with space, personnel is a function of people and time over a given space. A trauma Person-space-time continuum.

Ideally, you would have a full fledged trauma team for each bed in the ED. But you won't. What you will have is a cobbled together group of people to carry out the function of each section of the hospital. It's up to the leaders of these sections to prepare for situations like this and know how to parcel out the available resources and at the same time call in more. The best strategy for dealing with the initial volley of casualties is to place the highest density of care givers in the areas most likely to see the most serious injuries AND force-multiply as much as possible.

For example, in this same 25 bed ED on a game day, there may be three ED attendings, four ED residents, a surgery resident, a surgery intern, a surgery chief resident, and a surgery attending in-house. To accomplish the biggest-bang-for-the-buck, the most reasonable solution is to put the most skilled and confident trauma providers singularly in all the resuscitation bays, and then use the rest of the available

people to care for and force-multiply the rest of the ED. In this example, in order of most serious expectation in the resuscitation bays a reasonable staffing solution would be: Room 1: Chief Surgery resident, Room 2: Junior Surgery Resident, Room 3: ED most senior resident, Room 4: ED next-most senior resident, Room 5: Next most senior ED resident or surgery Intern, the surgery attending is acting as the triage officer (see Triage Officer section below) This covers all the rooms where the most serious injuries will likely be triaged. This also leaves five more ATLS providers to see the other 20 rooms. While this seems less than ideal, it is a reasonable plan. Each of those 20 rooms can be manned by one or one half nurse or tech that has some experience caring for the injured. Nursing must come up with a similar plan to parcel out their available people in the ED and staff each room while calling in everyone else they can.

Anesthesia is usually stuck up in the operating room. The most efficient MASCAL system I have ever seen relied on all available anesthesia providers to come down to the ED and "float" from room to room to help intubate if needed or, if there are enough, man the head of the bed at each of the five resuscitation beds. As cases come in, get evaluated, and need to head immediately to the operating room, the anesthesia person at the head of that patient's bed simply goes upstairs with them.

Call in plans should be executed, and *everyone* should come in. One thing to be particularly aware of is where each work force assembly area should be. The most efficient system I have seen is for all surgeons and emergency medicine providers to assemble in the triage area in an organized way, within eye and ear shot of the triage officer. In this way the triage officer can see a patient, see an available surgeon or emergency medicine doctor he/she knows, and assign the patient to the provider. When patients leave to go to the OR, the surgeon goes with them, or the triage officer assigns another surgeon to go. When a provider is done with the patient (an operation completed or no operation needed), they return to the assembly area, stand against the wall, and line up to be re-assigned. Worker-bees.

These worker-bees should include anyone who works in the facility with a general surgery background such as vascular surgeons, surgical oncologists, minimally invasive surgeons, colorectal, etc. Remember, they all know the basics of ATLS and can perform a damage control laparotomy. Do not underestimate the value of a capable general surgeon. Not everyone has to be some famous trauma surgeon to do basic damage control.

Other services (medicine, critical care, family medicine, GYN, etc.) and call-in folks(nurses) will need their own, specific assembly areas. The best strategy in developing this part of the plan is to have surgeons and emergency medicine people assemble in the triage area and others assemble elsewhere. Having too many people in the triage area could prove to be cumbersome and inefficient.

But the philosophy will be the same: Personnel will be assigned Space and will MOVE in and out of the space as the clinical situation presents itself.

THE BIGGEST BANG FOR THE BUCK

Or, more specifically, the function of the hospital that will help the most patients to best mitigate death and suffering. As much as the surgeon in me wants to believe its the magic that happens in the OR that is the biggest bang, it isn't. The biggest bang for the buck is providing adequate, prompt ATLS care in the ED. Stopping external bleeding, placing chest tubes, intubating patients with airway compromise, and giving blood to the bleeding is the most helpful set of skills to keep your casualties alive. Sure, a lot of these patients will need to go to the OR. But most who arrive alive and do NOT have penetrating abdominal or pelvic injuries can be temporized with pressure or tourniquets, making OR room for those who do.

For this reason, the focus of getting casualties efficiently in and OUT of the ED is paramount.

THE RATE LIMITING STEP

The area of the hospital that will have the *least* efficient turnover is the Operating Room. By definition, this is the rate limiting step. The name of the game in the OR is damage control..in every aspect, surgery and resuscitation. After all the support is called in and assuming adequate surgeon staffing, the best strategy for getting in and out of the operating room safely and efficiently includes:

1. Limit operations to one hour. At the one hour mark have another capable surgeon scrub in. Making this a rule mitigates the very-real underpinning of self consciousness of the surgeon already in the case. It shouldn't be a person asking for help at the one hour mark. It should just be a rule. More hands go faster than less hands.
2. Only tackle life-threatening operations initially...penetrating truncal trauma. Even vascular injuries to the extremity can technically wait (providing bleeding is controlled with a tourniquet) with a tourniquet until appropriate rooms and personnel arrive to help.
3. Try and put two surgeons on every extremity or in every open cavity. Two sets of hands can go way faster than one. This is especially true for amputations and/or major bleeding control in the extremities.
4. Utilize "other" surgical help for all these cases. Urologists and Gyn surgeons can provide a valuable set of hands even if they haven't done trauma operations in twenty years. Using them also frees other general surgeons to open other rooms or other cavities in patients that need it.
5. Don't cause trouble later by NOT being conservative. If there is a hole in something, explore it. Don't leave something unexplored for the people in the ICU to worry about. If you are in the abdomen and there is a zone 2 neck injury, call your friends and have them explore it and take injuries off the table.

The OR should be another revolving door. Try and stick to the one hour mark. The triage officer is very important here. When surgeons look to be dawdling, its the triage officers job to insert another person into the case that can move it along. Surgeons must follow this person's lead and leave their feelings at the door. Cry later when the dust has settled.

Have a single point of contact in the operating room. Many hospitals, mine included, have two people that require input when booking cases: the board runner (nurse) and the anesthesia person in charge for the day/night. It doesn't matter who the contact is going to be, but choose just one. This is something that needs to be worked out ahead of time so that both the nursing staff and the anesthesia staff work efficiently without creating a communication nightmare.

The operating rooms are triaged by the triage officer. There needs to be a system where he/she knows how many rooms are open at any given time. So the flow of information goes from the initial MASCAL event kicking off and the triage officer and whoever is in charge of the OR speaking directly to each other about exactly what is immediately available. As cases get booked, the triage officer TELLS the board runner what is going to come to the OR. Then the triage officer marks that room off. As rooms come available (more staff coming in or cases turning over) the OR contact lets the triage officer know and the system keeps going.

TRIAGE CATEGORIES

The traditional NATO DIME triage categories (Delayed Immediate Minimal Expectant) are the easiest and most comprehensive triage system used around the military world. It is ideal for hospital MASCAL situations because it helps sort patients into both urgency as well as geographic areas. Other triage tools are used in many cities around the world. The most common in the US is the Red, Yellow, and Green tag tool. But this isn't helpful in the hospital because it doesn't incite a specific call to action the way the NATO system does. For this reason I have only used the DIME system with one small addition.

The traditional NATO system groups patients into five categories: Immediate, Delayed, Minimal, Expectant, and Dead. What we realized was there was a functional sixth category, Emergent. This became our Modified NATO system we used. We will discuss these categories in order from simplest to most complex, both from a urgency/treatment standpoint as well as a geographic standpoint.

Dead

Dead is dead. There's no two ways around it. But there has to be some consideration as to what to do with and where to store the dead during a MASCAL. Remember, a stadium just got blown up and hundreds of people are on the way. You will need to move the dead promptly to an organized collection area that is large and out of the way. This needs to be practiced as well. The best place is a morgue if your hospital has one. If they don't you will need to find a secluded area where the bodies can be collected, preferably on a different floor or way out of the way of the action. Death is a part of a MASCAL, dead bodies lying around where the caregivers are doing their best to help them are a bummer and bad for morale.

Expectant

The traditional concept of expectant was the gunshot wound to the head in Vietnam who arrived alive to the field hospital. They were *expected* to die, so they were made comfortable and put out of the way. But expectant is a relative concept, relative to the resources at your disposal. With a modern hospital with modern ICU care and access to both neurosurgeons and transport out of your facility, expectant should be a very rare situation. In fact, during my time in Baghdad, over thousands of patients and many MASCALS we only made one American expectant. The rest were put on the ventilator and shipped out. Conceptually, a MASCAL in a modern civilian hospital will be similar. Penetrating injuries to the head that are not expected to survive can still get intubated and go to the ICU where final decisions about them can be made later. But you should at least have the discussion about what to do with patients who aren't expected to live and ICU space is running out and there is no movement out of the hospital any time soon. A terminal extubation and comfort care is completely reasonable.

Minimal

The best way to describe minimal is to paint the word picture of nearly every MASCAL I ever saw. Most patients arrive in trucks or other non-emergency vehicles. When they did, it was very common for us to holler "OKAY. STAND UP AND GET OFF THE TRUCK!" Those who could were minimal. I never saw them again. These are folks with a forearm fracture, cuts on their legs and a left pinky toe traumatic amputation, minor burns, and the like. If they can walk they are not serious enough to come to your busy place. Have another place for them.

The most ideal place for the minimally injured is a clinic or some other care giving facility very near your area so people can walk there on their own. Ideally it is staffed with nurses or techs who can dress wounds and give some oral pain medicine. The Medical Office Building or similar next door to the hospital is a perfect place. Clinics that have a lot of dressing supplies, such as surgery, dermatology, and plastic surgery are ideal.

Ostensibly, there will be some tough customers who have a much more major injury than was originally thought; a penetrating injury to a brachial artery that now has a pulseless hand, for example. In that case the caregivers in the minimal area need to know how to walk someone over to the triage officer and get the patient where they need to be.

Delayed

The Delayed area will be the busiest part of the hospital. These are people with *real* injuries but just not serious enough to make it to the Immediate or Emergent areas, penetrating injuries below the knee or elbow, blunt fractures of all types that aren't that sick, burns that don't involve the airway or over 10% of the body, etc. They will almost all need some type of surgery...just not right now. The expectation is for 100 people sick enough to make it to Immediate, 300 will be triaged Delayed.

There are several hard and fast rules about the Delayed area:

1. It should be huge. Enough space to house 300 people or so.
2. It needs to be staffed by nurses and techs.
3. It needs to be stocked with dressing supplies and pain medicine.

Remember, these patients will all be injured, most of which will have penetrating injuries or burns of some type. These require dressings +/- a washout, splints, and narcotics. Nurses and techs are the workhorses. They will be the initial evaluators, wash outerers, and dressing placers of all the injured. This workforce will be made up of mainly floor nurses...from a variety of floors, not just the surgical floors. It is imperative that during the planning process a training module be made available on a simple way to evaluate these patients.

The medical leader of this workforce will need to be a doctor that is NOT an emergency medicine person or surgeon of any type. These people will ALL be occupied elsewhere. This person can be an internal medicine, family medicine, other specialist. The best Delayed area medical officer I've ever worked with was a dermatologist. She was familiar with wounds and had a calm demeanor. Find willing participants who can act as medical officers of the delayed area and set up a training module for them as part of your training process.

The geographic location of the Delayed area will depend on the particular set up of your hospital. The best, most reliable location in many hospitals is in the hallways of the wards. They satisfy all three of the requirements above: they have a built in workforce, they can accommodate a large number of people (we can fit over 300 people in the hallways of our floors), and (maybe most importantly), all the supplies are already on the floor. Other areas in or around the hospital will be thrown around as possibilities: the education center, the gym next door, the cafeteria. Avoid these if at all possible. Getting supplies to these areas is a difficult enough task, but other logistical things can prove to be more annoying than helpful, such as communication and labor pool delivery.

Immediate and Emergent

The Immediate area is where most of the death will be mitigated. This is the Emergency Department. Abandon all the ridiculous ideas of setting up tents outside your building or an alternate area during a MASCAL. That is disaster.

Patients coming in to this area are all patients with penetrating injuries above the knee or the elbow (includes the trunk, neck, and head), the unconscious, and blunt injuries that are hemodynamically unstable or have peritonitis...the usual customers in a busy Emergency Department. For the most part both these areas will occupy the resuscitation bays and other rooms in proximity to them.

But there is an important realization that needs to be recognized regarding the personnel at your disposal. Not every person has the same skill and comfort running big, bad trauma cases. This is true for both surgeons and emergency medicine physicians. Even if you had the entire complement of surgeons, emergency physicians, and residents, not everyone has the same ability to perform under pressure. Best

thing is to recognize this fact and create your system to reflect it. This is especially true considering you *won't* have your full complement of surgeons and emergency physicians.

Because of this, another triage category, EMERGENT, was developed. The EMERGENT area is more densely staffed with nurses and techs, has more readily available equipment, and has more experienced and comfortable surgeons running the show on each bed. In our case the resuscitation bays will act as the EMERGENT area. These bays are the areas where lifesaving procedures are most likely to be performed. It doesn't suggest that those same procedures *won't* be performed elsewhere in the Immediate area but if you were to put the odds in your favor you would be smart about things like people and stuff density.

There is a technique to triage this area as well. While it may make sense to put the *first* patients that arrive into this area, you have to remember it's for the *worst* patients. You also have to remember all these MASCAL events bring patients in waves, and while the most serious are likely to be the first to arrive, there's every bit the possibility that several or many severely injured patients will arrive beyond the first wave. In this case you would be remiss to have already occupied these bays/beds with less severely injured patients when patients that are worse off arrive at the door in the following few minutes. Put the odds in your favor.

So we used a simple tool to get patients into the EMERGENT area: They could not have a radial pulse nor could they be conscious. That's it. A patient who's blown up, missing a left lower leg, has holes in his chest and abdomen and screaming for his lost child is one thing. The same guy pale and unconscious is another. The second one makes it to EMERGENT, the first one remains IMMEDIATE.

Recognize the differences in your staff and have that reflect the differences in the casualties that will arrive. Put the odds in your favor.

THE TRIAGE AREA

The Triage area is the focal point where, at least, all the Delayed, Immediate, and Emergent patients are sorted out. Ideally, the minimally injured are sorted out before they get to the Triage Area because most/all these patients aren't going to be entering the facility anyway. The planning for/position of the Triage Area should follow several simple but important rules:

1. There must be only one way in and one way out of the Triage Area. This seems like an easy ask but sometimes architectural or structural decisions made years ago make this rule a bit more difficult to plan for. For example, at the old University Hospital in San Antonio there were two main areas where patients entered the ED: one was the front entrance near the ambulance bay and the other was the elevators that lead to the helipad. This system worked great for them for the normal trauma flow and day-to-day triaging system. But in a MASCAL, this could be a real problem. While the Triage Officer and crew are sorting out patients into the appropriate categories and space, theoretically another group of patients could be entering the facility and occupying important space/people without the knowledge of the Triage Officer and outside the system. This would not be good. It could lead to massive confusion, overlap of patients into limited space, and potentially poor outcomes.

If this is the case in your hospital, the best way to create a safe, single Triage Area is to work with your hospital operations and security personnel to create a pathway for the patients and their prehospital providers to enter through the main Triage Area. This might end up being a very circuitous route and could get complicated. Putting your minds around this problem ahead of time would be worth all the effort. Fortunately the likelihood of many patients coming via air in this scenario is very low. Most of the patients will be arriving by truck/car/police. In this case it's

important to work with your security and operations people to seal off other pedestrian entrances to the hospital for casualties.

There are two examples of this type of situation. The first is one of my deployments outside of Tikrit, Iraq. The emergency entrance was in the very front of the hospital, just off to the side of the Landing Zone, where many of our casualties entered. But there was a back area of the hospital very near a road. There was nothing about this back area that seemed like any sort of real entrance to our facility, especially to the trained eye. The front entrance was well marked and there were generally lots of people around this area ushering casualties to the Triage Area. But remember, it was still a Combat Support Hospital (CSH) with red crosses on tents and ambulances parked outside. To a panicked kid driving as fast as she can with a truckload of casualties it's still a CSH and it's close to the road. We could see how easily someone could mistake this for an entrance, pull in, and expect us to be in the position to help. But we wouldn't be there, nobody would be. So we paid special attention to this in setting up the security around the hospital during an MASCAL. The soldier tasked with security in this area was instructed to point any and all casualties to the front of the building.

The second is my current situation. Functionally we have two main entrances where casualties could arrive: the Lower Level where the Triage Area/Emergency Department entrance will be very clear to everyone arriving, and the front entrance that is normally used for elective surgery drop offs, etc. In the heat of the moment, especially in vehicles driven by civilians, this front entrance looks like a *real* entrance to the hospital. But, just like in the CSH example in Tikrit, it isn't. There would be nobody there to help anyone dropping off patients in this area. So our plan is to involve our security personnel to seal off this area to any casualty traffic and direct them around the corner where they will be funnelled into the appropriate area.

2. The Triage Area must be in close proximity to the Immediate/Emergent Areas. This is an important rule to follow because of the ebb and flow of a *real* MASCAL. In real life, Immediate and Emergent casualties are entering the area, being triaged appropriately, and being treated in the ED. But from here several other decisions will be made about the casualties; things like operative decisions, ICU admissions, etc. The Triage Officer will need to be a part of all these decisions, as will the other leaders of the hospital. As in any case with multiple moving parts like this, two forms of communication are better than one. Physically/Visually interacting with the Triage Officer and the clinical providers is an essential tool to create a safe system of movement.

In all my *real-life* MASCALs, the Triage Area was in close proximity to the action. So much so that the Triage Officer could easily be seen and heard by anyone in this section of the CSH. This enabled the Triage Officer to poke his head into the ED during the normal ebb and flow of the situation and get a better understanding of what was happening. The value of this can't be underscored enough. Remember there is a constant movement of casualties moving in and out of the ED. Likewise the leadership, experience, and confidence of the Triage Officer will move in and out of the ED.

Resist the urge to overthink the situation and plan a Triage Area that's not close to the action. When I was getting out of the Army I interviewed at a busy Trauma Center. During the interview I was taken on a tour of the facility by a famous Trauma Program Manager. She knew I was interested in Mass Casualty management and I asked her where the Triage area was. She walked me through the ED and out into the ambulance bay. Then she pointed down the street, about a quarter of a mile away, where ambulances turned off the main road onto the smaller road leading to the bay where we were now standing.

"There it is." She was proud.

"Way down there? How come it's so far away?"

"Because when we had the plane crash a few years ago, there were patients who arrived covered in fuel! This way we can triage them far away from the hospital and clean them off before they get into the building."

"But that's not how it's going to go in *real-life*."(now I'm teaching her...on my tour) "In *real-life* everyone will gravitate way closer to the action, and what you're pointing at is way, way far away."

"Uh, huh." She wasn't impressed.

I didn't get that job.

Her idea was a reasonable one. It would stand to reason that maybe some explosion event or plane crash, as in her experience, would yield casualties covered in some sort of fuel or something and a Triage Area at a distance could potentially make for a safer work environment for both the patients and the casualties themselves. But that's not how *real-life* actually works. In *real-life* the injuries caused by the explosion or crash take exponentially more precedence than the fuel or whatever is soaking their clothes. And in this scenario the impact of being very close to the ED is a paramount function of the Triage Officer.

3. The Triage Area should be under cover if possible. This isn't a hard rule, but if it can be pulled off it's preferable. It certainly shouldn't be traded for proximity. In Baghdad, the Triage Area was just inside the ambulance bay doors where the Immediate/Emergent patients were sorted and took a right into the ED and the Delayed patients were sorted and took a hard left and headed down the hall to the Delayed Area. While comfort isn't a major priority, being exposed to wind, rain, snow, cold, or heat can be an unwelcome distraction during an MASCAL. If your hospital has a covered area in close proximity to the ED entrance that has good egress for both I/E patients as well as Delayed patients, this is a good location.

It will most likely require some sort of change in your normal traffic pattern for the incoming casualties. This will require a good planning session with both the security and operations folks in your hospital. For example, in my current building, the Triage Area is in the huge ambulance bay with a single entrance into the ED. This is ideal for our purposes, but it requires a change in the traffic pattern of the ambulances and other vehicles that normally drop-off patients in this area. Good planning with security to recognize these changes and set up a traffic pattern that can help facilitate the Triage Area location is essential.

TRIAGE OFFICER

The Triage Officer is the person that does the sorting of patients. In the simplest terms, he assesses each patient and triages them to one of the DIME categories. The minimally injured patients are deemed minimal and ushered off to another area. Patients with injuries that confine them to a bed or litter but are not thought to be life threatening right now are sorted into the Delayed category and guided toward their area. Immediate and Emergent patients are also sorted appropriately and fed to the most appropriate bay in the Emergency Department. On and on this will go, and it is best for the person doing the sorting be someone who is experienced, competent, and confident in dealing with a wide variety of injured people.

The US army still teaches that the Dental Officer should be the Triage Officer in a MASCAL, ostensibly because they are somewhat familiar with medical stuff but not really necessary when it comes to actually treating medical problems. Essentially they know enough to do the job but won't be missed in the

operating room or Emergency Department. This couldn't be a worse decision. Nothing against dentists, but put your brain around the logic here. This is arguably the busiest, most exciting medical event in your life (and the lives of everyone working with you) involving the most seriously injured people you've ever seen...by the dozens. The key to mitigating death is to *MOVE* patients through the ER in a way that maximizes your effectiveness. The first step in this process is putting the right patients in the right spot to stack the odds in your favor. The person making those decisions not only needs to be familiar (and comfortable) with a wide range of injuries, but also familiar with the capabilities of the staff to appropriately triage the immediate and Emergent categories. The whole system depends on this person making good decisions with a level head. It's not the job of a dentist.

But then who?

The best way to answer this question is to consider *what's* being triaged. Most people have the concept of triage in their head that reflects the DIME method outlined above. Which is to say the things being triaged are things at the door...or *just* at the door. If this were the case, it would make sense to have any experienced trauma provider be the triage officer: A nurse, an emergency medicine doctor, or a trauma surgeon.

An experienced nurse seems like a good idea. They normally do all the triaging on a day to day basis anyway, which is to say they field incoming radio calls from EMS and alert the appropriate medical personnel as appropriate. "SUSPECTED MI COMING IN TO SEVEN IN FOUR MINUTES!" etc. And for the most part they are excellent at this job. It takes some skill and savvy to put the right person in the right room to be treated by the right people. This would be a logical choice. But two things work against the nurse-as-triage-officer: Scale and Nurse Management.

When multiple (tens) of severely injured patients are coming in at the same time, the normal thought process that's used by the triage nurse doesn't work well. Remember, who is sorted into Immediate and Emergent can be the difference between life and death. And it's not only patients getting sorted into those particular rooms, it's surgeons and emergency medicine physicians, and other physician staff. And gone is the requirement to alert the physician staff as to the when and where the patients are coming. They are all coming, right now. Now, it's just the experienced brain out front deciding which patients go to the delayed area, and which patients enter into which section of the ER. For this you need your most experienced trauma provider who not only can make these decisions, but has the gravitas to sort out the many physicians into rooms that best suit the situation. A nurse will have a near-impossible time doing this job, no matter how experienced. The fact is: doctors need to get sorted according to their ability. They don't like listening to a nurse about where they should or shouldn't be. This relationship/interaction is a very real phenomenon. If the doctors don't suck it up and go where they are told, the system will fail. This is one reason it can't be a nurse.

The other reason is that the most experienced nurse leader in the ER who would normally be thought of to assume this role is also the most experienced nurse manager of people. In a real MASCAL situation, the number of nurses (at least initially) will be small compared with the job they are about to tackle. Managing which nurses and clinical assistants go to which room in the ED is as important as which physicians do the same. This nurse management skill isn't going away until the entire thing is over. The bottom line is he/she is going to be so busy managing his own people that there is literally no more time to go out front a triage. This is almost a bigger deal than the clinical interaction limitation.

So that leaves the emergency medicine physician or the trauma surgeon.

Emergency medicine makes sense. They are certainly experienced with trauma and triaging patients. They are well respected and have enough skins on the wall to reasonably assign physicians (even most surgeons) into rooms according to their abilities. It would stand to reason that they should be out front

running point. But two things keep them from being the best choice for a Triage Officer: 1) Their value as a force-multiplier and 2) the other things that need to be triaged.

In most circumstances, there are fewer well-trained ER physicians than there are Immediate and Emergent beds. The ideal situation is to put experienced surgeons and ER physicians in every room. But there's simply not enough. Certainly there is some thought to placing the MOST experienced people available at any given time in the areas expected to see the most serious casualties, but the reality is that the more senior surgeons will start vanishing to the operating room, leaving the more inexperienced providers to staff the Immediate and Emergent areas. You'd like to use ED physicians as much as you can, but there simply aren't enough of them. In Baghdad, we used other physicians (Gynecologists, Urologists, and Orthopedists) that were capable of managing a trauma patient but not necessarily the most experienced, at least initially, in some of the procedures necessary to provide good ATLS-type care: chest tubes, intubation, surgical airways, and central venous access. This is where good ED physicians make their money during a MASCAL. If I have, say, 8 Emergent beds and only two experienced surgeons and two ER physicians I can staff two beds with surgeons and six with Gyn's, urologists, and orthopedic surgeons. The ER physicians can then "float" amongst the beds providing some procedural expertise to the providers who may need it. Now I've just tripled my ability to provide the Biggest Bang for the Buck.

In a civilian scenario, the gynecologists, urologists, and orthopedists are replaced with general surgeons in your hospital that are capable but haven't done trauma in a very long time. Many of these folks are very uncomfortable in this situation and providing them some procedural or thought-process backup is a major force-multiplier. In a typical hospital, certainly a Level I trauma center, there are quite a few physicians who have trauma experience but don't use it every day that can staff at least an Immediate bed (general surgeons who haven't done trauma in a long time, urologists that did two years of surgery way back when, orthopedists, surgery and ED interns and junior residents). When you start adding up all these people that are available to you as a hospital, you can staff quite a few beds, and having floating ED physicians that are comfortable and capable of performing ATLS procedures and lending their trauma brain becomes a real asset.

At the beginning of the MASCAL, there are only a few ED physicians working in the hospital at the time. When more of the physician/surgeon work force is called in, it simply allows the hospital to operate more Immediate and Emergent beds, which still requires a certain amount of the ED physicians to float and help. Because of this force multiplication issue, a good way to look at an ED physician is for every experienced ED physician, I would take out and make the triage officer, I reduce my ability to provide safe care in four to six Immediate or Emergent beds. At fifteen minutes per bed turnover, that's about 20 patients per hour.

The other, more important, reason an ED physician shouldn't be the triage officer is because triaging doesn't stop at the front door of the hospital. In fact, two other areas need to be triaged from the ED: the operating rooms and the ICU.

The ICU is easy. Any patient who's intubated or otherwise needing the ICU gets triaged to that area. Usually, the triage officer has a list of available ICU rooms and simply assigns a patient to that room and that is that. But those rooms can get relatively scarce, and somebody needs to be in charge of responsibly utilizing that space.

The operating rooms are a bit more difficult. In an explosion event, nearly every casualty is going to need to go to the operating room at some point...wound washouts, orthopedic fixation, etc. But the major triaging event for the operating rooms initially revolves around life-threatening injuries to the trunk, major vessels, or brain. To each surgeon caring for a patient in the Immediate or Emergent areas, their particular patient is the most important, and if they need an operation, their instinct is to move them to the

operating room. But someone needs to be in charge of this area and appropriately triage the cases, otherwise it is chaos.

So now you have three separate areas of the hospital that need an experienced brain to triage casualties into the appropriate spot: Trauma at the door, the ICU, and the Operating Rooms. The trauma surgeon is the one provider who has intimate working knowledge of all three areas of the hospital. For this reason, the best triage officer in your hospital is your most experienced trauma surgeon.

Other possibilities certainly exist to have *multiple* people triage multiple areas in the hospital: an ED person at the door, a surgeon for the operating rooms, and an intensivist for the ICU. But this now takes three people out of clinical care delivery, not one. This would not be a very efficient option. Likewise, using a nurse or anesthesia provider to triage the operating rooms doesn't address the simple fact that OR nurses are going to be in very short supply. Much like experienced ER nurses performing their duties in the ER, an OR nurse in charge is going to have his hands full managing each room, equipment, personnel, etc. Similarly, anesthesia providers are going to be passing gas and resuscitating people. They can't spend time telling which surgeon can or can't bring her case to the OR. This needs to be a surgeon. And if you're going to use a surgeon to triage the OR, then you would be well served to have him do it from his position in the triage area and act as the Triage Officer at the door as well. Nobody is more qualified to do each job...doing both is ideal.

In the setting of a Level I center the best situation would be to use the trauma attending on-call as the initial triage officer. The call-in plan would then go into effect and a pre-identified triage officer would come from someone on the trauma surgery staff...usually the most experienced trauma surgeon, ideally someone who has done this before. When that person arrives, they simply take over Triage Officer duties and allow the on-call surgeon to return to the pool of surgical providers.

A few notes on the trauma surgeon you choose to be the triage officer that may affect their ability to effectively run the MASCAL incident:

1. The triage officer should be very level headed. Folks who have a hot head or run their mouth to the detriment of good, safe care should not be considered. It is going to be a stressful environment. Surgeons who have a tendency to create more stress would not make the system run any smoother.
2. The triage officer needs to be experienced, but not necessarily the eldest person on the staff. You know your faculty well. Just because someone has been there for many years doesn't necessarily mean they would be good at this job. Competence, organization, and trust are the major components of a good triage officer.
3. The triage officer needs to triage the operating rooms. This person needs to carry the right sort of gravitas and trust to have his decisions well received by the surgeons seeing patients in the ED. This is not an insignificant issue. Surgeons, by nature, are bossy and don't like to be bossed around themselves. To be told they may have to wait with their patient will be unusual, especially when the patient may have life-threatening problems. The person acting as the triage officer will need to be in a position of respect in the community so that when they make a decision, it is trusted and his direction followed.
4. Resist the urge to put someone other than your most experienced trauma surgeon in the triage officer role after all the call-in's arrive. This is most commonly an issue when someone in the hospital leadership is a busy-body and wants to run things at the door, such as a Chief Medical Officer. Those people will have more to do than they originally thought anyhow and should not be the triage officer.

MOVING PEOPLE OUT

Perhaps the biggest difference between Civilian and Military trauma systems is the ability for the military to move casualties out of one hospital and to another one with relative ease and efficiency. Nowhere does this seem more effective and more noticeable than in a MASCAL situation. Keeping with the philosophy of Moving through Space, it doesn't end when the operation is done. If there was an open, revolving door for casualties to come in, get a lifesaving operation, recover for a short while, then safely leave to go somewhere else, it allows for a decompression of the system and makes the concept of *capacity* a relative one. The problem is Level I trauma centers may be the absolute worst hospitals on earth at moving patients OUT. It is just so infrequent at most places that they are lousy at it.

The process of moving patients out begins with the Triad of the Triage Officer, The Chief Nursing Officer, and the Chief Medical Officer. Together they keep redundant lists that monitor just how full the hospital is and how full it is getting. An arbitrary number is 80%. But when 80% of beds are full (including all the makeshift beds in the hallways and doubling up in the ICUs), a switch is pulled and the CMO executes the exodus.

Together, the CMO and CNO go ward to ward, starting in the ICU, and identify the patients that would be the safest to travel. After this list is compiled, travel arrangements are made with ambulance companies, ambusses, air travel, etc, and the patients are prepared to safely leave and get to where they are going. This in and of itself is hard. The safe packaging of patients and getting them safely out the door is something that needs to be taught and practiced.

But the hardest part is finding the assets to move all these patients as well as their ultimate landing spots. This requires pre-planning on the part of the CMO and regional trauma/hospital organizations. There should be some building blocks of the exodus plan that include:

1. Willing accepting hospitals during an event like this, both inside and outside this region
2. A working knowledge of the transport assets available during a time like this, both in and out of your region
3. Contacts at the regional and local level outside your hospital network that can help if you need them

All these things take planning well ahead of time. But if planned for and executed well, the MASCAL can continue to run efficiently because decompression on the back end helps open rooms on the front end.

HOSPITAL LEADERSHIP

In many hospital systems, MASCAL exercises use hospital leadership in the Incident Command Center (ICC), which is a place likely near the C suite where the C suite people get together and monitor the situation and field phone calls. In *real-life*, it doesn't happen this way at all. The most action the hospital has ever seen is coming through the Triage Area and, so far, in my experience, it is impossible for the CNO and CMO to avoid. In fact, their presence in the Triage Area near the Triage Officer can be quite helpful. They can keep a real-time list with pen and paper themselves rather than having it relayed through radios or runners. They will use this list to enact the exodus plan. The ICC does have a good place and function, though. It is a good place for hospital operations folks to be where they can get more supplies to and around the hospital. But the major clinical leaders of the hospital are useless there. More importantly, they will *always* gravitate to the action. The best plans just include them in the Triage area, and don't bother with the facade of having them in the ICC.

COMMUNICATION

One thing that can break a good plan is terrible communication. In the scenario we painted, there may be a reasonable risk that all cell and VOIP communication in the hospital is not working. In this case, you pretty much have two choices, runners and radios. Our hospital has several radios that we keep charged and maintained just for this reason. If you decide to use radios at your hospital, practice using them. During the MASCAL planning or practice sessions, have the assets that are going to use radios use them. Also, limit the clinical radio net. Set that to a specific channel that no one else uses. On this net should be the Triage Officer, the person running the Operating Room, and the Person running the ICU. Resist the urging of others to want to be on that net. It will just cloud the picture.

ICU

Most ICU's in modern hospitals have redundant Oxygen, suction, and air to be able to double occupy each room. Put a plan together that takes advantage of this. Also, plan on moving all moveable patients to the MICU and double occupy their space. This will leave as much open space in the SICU/Trauma ICU as possible to let those nurses do their thing. It's a lot easier to get trauma ICU nurses to double up than to get MICU nurses to manage resuscitations.

The medical leadership of the ICU will need to be someone other than a trauma/critical care surgeon. All the surgeons should be operating. Hand the reins to the most salty PA or nurse practitioner that usually works in the ICU or put in your plan to engage the pulmonary/critical care folks to manage your ICU until your people are free to do so.

PITFALLS

Not Committing to a new culture of Movement

There will be a few nay-sayers to the pop-the-brakes-and-roll philosophy. They will cry safety and ratios. Don't listen. Commit to changing your culture of movement and practice it. Anything else and you will get bogged down in the ED and you will make that be the rate limiting step, which will not mitigate death and suffering.

Practicing something other than Movement

This is incredibly common. Many hospital and city-wide MASCAL exercises practice things that are unrealistic. For example, they dress people as moulaged casualties and have folks pretend to treat them. It's unrealistic that person will learn something that will change their usual practice. When the world turns upside down during a real MASCAL event, all of your clinical providers in the ED will do what they do all the time. And they should. It's all about ABC's and ATLS. Having clinical scenarios is a waste of time. It keeps you from practicing what's really important: moving people safely around your hospital and moving people out of the hospital. Get your regional trauma system to participate in this new plan.

Not Practicing Moving People Out

This is a very important part of running an efficient MASCAL. Have all these things planned out. You might not need to cross all the T's but have the broad strokes in place:

- What is the trigger to purge the system?
- Where are the patients going to go?
- How are they going to get there?
- Who are my contacts outside of my region that I can readily call and get some help?

Big Confusing Plans

It is very common for a hospital to have a singular MASCAL plan. Typically, it's rolled up into another Disaster Management plan, like what to do if there's a tornado. This is a document in a binder with about 300 pages. This is not helpful in any way. When the stadium goes up and hundreds of people are on the way, nobody has time to sift through more than two pages. So make your plan a one or two pager. Have them made specifically for each area of your hospital. For example, the MASCAL plan for our surgical ward is two pages. It begins with "There has been a mass casualty situation. You are on the 4th floor. Begin identifying open rooms and start the process of clearing the hallway to accommodate patients (see page two for a map of the floor layout).." It tells them exactly what to do, where to go, who to call, and how to call people in. Most people can handle this amount of information. Big confusing plans are useless.

Access to Narcotics

Nurses in the ED, the ward, and the ICU are going to be dealing with pain. They will need to give lots of narcotics, as they are used to doing. But all the surgeons and ED physicians will have exactly zero time to write any orders for these narcotics. Come up with a plan to allow nurses to be nurses and deliver necessary pain medications when they feel they need to. Relying on the usual process will ultimately be futile.

Electronic Health Record

Forget it. Go to down time documentation on paper. The best thing you can do is have 500 pre-made trauma packets ready to go at all times. They should include: Trauma Name and Unique Identification Number, Bracelets and stickers that match, a generic order form, and a easy to fill out brief history and physical exam. The most important pieces of that packet are the bracelet and the stickers. You will be giving huge amounts of blood products. For the most part, that's the only real important information you need.

If you use those intra-office mailer envelopes that have the little button and string on them, you can collect any of the patient's personal property and put it in the envelope.

If there is no time to even fill out the little H and P sheet in the packet, have a simple backup plan. One that is very useful is to put a piece of tape on an uninjured part of the body and write the main diagnosis and your name. That way if anyone has questions they know who to ask. HEAD INJURY—AYDELOTTE.

REFERENCES

There are none. This is all personally learned and collected information.

SESSION 5

AUDIENCE INTERACTIVE SESSION

Session Coordinators: Alexander L. Eastman & Jennifer M. Gurney

Sunday, March 27, 2022

2:00 – 2:30 PM

Palace Ballroom 1-2

Palace Tower

Emperors Level - 4th Floor

BIOLOGICS, RADIATION, AND DIRECTED ENERGY: ARE YOU PREPARED?

SESSION 6

AUDIENCE INTERACTIVE SESSION

Session Coordinators: Matthew J. Martin & Melissa "Red" Hoffman

Sunday, March 27, 2022

2:30 – 3:00 PM

Palace Ballroom 1-2

Palace Tower

Emperors Level - 4th Floor

ETHICAL, MORAL, AND LEGAL RISKS IN DISASTER AND MCI CARE

3:00 – 3:30 PM Break and Visit Exhibits
Pompeian Ballroom
Palace Tower
Promenade Level – 3rd Floor
(Take Escalator or Elevator Down One Floor)

SESSION 7

BEYOND TRIAGE AND RESUSCITATION

Moderator: Kenneth L. Mattox

Sunday, March 27, 2022

3:30 – 6:15 PM

Palace Ballroom 1-2

Palace Tower

Emperors Level - 4th Floor

| | |
|--------------------|--|
| 3:30 – 3:45 | Hospital Emergency Response Team (HERT) Meghan R. Lewis |
| 3:45 – 4:00 | All Systems Down - Your Hospital has been "Kidnapped" Matthew J. Martin |
| 4:00 – 4:15 | Expectant Care: How to do it Well Melissa "Red" Hoffman |
| 4:15 – 4:30 | Location, Location, Location: Rapid Hospital Expansion Lessons from the COVID experience Zaffer A. Qasim |
| 4:30 – 4:45 | Whole Blood: The Ideal Product for Mass Casualty Events? Richard A. Sidwell |
| 4:45 – 5:00 | Hospital Evacuations Done Right Stephen L. Barnes |
| 5:00 – 5:15 | Rationale for Rationing: ECMO Access During the COVID-19 Pandemic Hasan B. Alam |
| 5:15 – 5:30 | Resiliency and Coping in Frontline Healthcare Professionals Alison Wilson |
| 5:30 – 5:45 | Code Orange in Your EC: Prisoner Bus Crash Sydney J. Vail |
| 5:45 – 6:15 | Late Breaking News Kenneth L. Mattox |
| 6:15 – 6:30 | Panel Discussion |
| 6:30 | Conference Adjourned |

HOSPITAL EMERGENCY RESPONSE TEAM (HERT)

Meghan R. Lewis, MD, FACS

Assistant Professor of Clinical Surgery
LAC+USC Medical Center & University
of Southern California – Los Angeles
Los Angeles, CA

I. Background

- a. Defined:
Hospital Emergency Response Team (HERT): Organized group of health care providers from a designated Level I Trauma Center, with Emergency Medical Services (EMS) Agency approval as a HERT provider, who are available 24 hours/day to respond and provide a higher level of on-scene surgical and medical expertise.¹
- b. Development in LA in 19922
- c. Purpose since 20082: to provide on-scene medical/surgical care for patients who cannot be immediately evacuated
- d. History of activations

II. Development

- a. Approval from individual components²
 - i. Local EMS Agency
 - ii. Fire Air Operations Unit/Sheriff's Department Air Operations Unit
 - iii. MAC/communication center
 - iv. Local level I trauma center³
 - 1. Surgeons
 - 2. Emergency physicians
 - 3. Nursing staff
- b. Writing a plan
 - i. Request for activation
 - 1. By whom (e.g. Incident Commander)
 - 2. How (e.g. MAC)
 - ii. Approval by Team Leader (e.g. Trauma Surgeon)
 - iii. Coordination of transport
 - iv. Team Assembly
 - 1. Limited space
 - 2. Can arrange for a second dispatch team
 - 3. Backup coverage of providers who dispatch
 - v. Preparation
 - 1. Activation to leave time is 20 minutes
 - vi. Transport to Scene
 - vii. Scene Safety
 - viii. Extrication
 - ix. Transport to nearest trauma center
 - 1. Communication for prepared receiving team

- c. Funding
- d. Equipment
 - i. Protective apparel for team members
 - 1. Hard helmets
 - 2. gloves
 - 3. eye protection
 - 4. ear protection
 - 5. Flame retardant apparel/jump suits
 - 6. Steel Tip Boots
 - ii. Supplies routinely available from on-scene paramedics
 - 1. Basic airway supplies
 - 2. Tourniquets
 - 3. IV started kits and crystalloid
 - 4. IO kit
 - 5. ATLS medications
 - 6. gauze
 - iii. Supplies brought by HERT team
 - 1. All supplies
 - a. pre-packaged
 - b. weighed
 - c. clearly labeled
 - 2. Specialized airway management equipment
 - a. video laryngoscope
 - b. cricothyroidotomy kit
 - 3. antibiotics
 - 4. Rapid Sequence Intubation medications
 - a. Etomidate
 - b. Ketamine
 - c. Midazolam
 - d. flumazenil
 - e. Succinylcholine
 - f. Rocuronium
 - g. Lidocaine
 - 5. Miscellaneous
 - a. Central venous catheter kit
 - b. Chest tubes
 - c. Topic hemostatic agents
 - 6. advanced surgical procedures equipment
 - a. Headlight
 - b. scalpel
 - c. scissors
 - d. forceps
 - e. clamps
 - f. Needle driver
 - g. sutures
 - h. Gigli saw
 - 7. Sterile field
 - a. Gloves

- b. Gowns
- c. masks
- d. drapes
- e. sponges
- 8. Blood
 - a. uncross matched RBCs
 - b. quantity

III. Initiation

- a. Leadership approval
 - i. EMS provider
 - ii. MAC
 - iii. Transport organizations
 - iv. Level I trauma center
- b. Obstacles
 - i. Equipment preparation
 - 1. Stored in a "prepared" manner
 - 2. Audited regularly
 - ii. Training of personnel
 - 1. Extra work hours
 - iii. Transport challenges
 - 1. Location
 - 2. Terrain
 - 3. Weather

IV. Training³

- a. Involve all personnel
 - i. Practice roles/responsibilities
- b. Realistic drills
 - i. Remote sites
 - ii. Detailed scenarios
- c. Frequency
 - i. Minimum annually
 - ii. Emphasis on new and key personnel

V. Quality Improvement

- a. Debriefs after incidents

REFERENCES

1. DEPARTMENT OF HEALTH SERVICES COUNTY OF LOS ANGELES (EMT, PARAMEDIC, MICN) SUBJECT: **REGIONAL MOBILE RESPONSE TEAMS** REFERENCE NO. 817
2. Scott C, Putnam B, Bricker S, Schneider L, Raby S, Koenig W, Gausche-Hill M. The development and implementation of a Hospital Emergency Response Team (HERT) for out-of-hospital surgical care. Prehosp Disaster Med. 2012 Jun;27(3):267-71.
3. Lombardi, J., Abramson, T., & Newton, E. (2021). Disaster Medicine. In D. Demetriades, C. Chudnofsky, & E. Benjamin (Eds.), Color Atlas of Emergency Trauma (pp. 282-294). Cambridge: Cambridge University Press.



ALL SYSTEMS DOWN - RANSOMWARE HAS "KIDNAPPED" YOUR HOSPITAL

Matthew J. Martin, MD, FACS

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"If you spend more on coffee than on IT security, you will be hacked. What's more, you deserve to be hacked"

Richard Clarke

BLUF (BOTTOM LINE UP FRONT)

- All healthcare facilities and systems are at high risk of cyberattacks and compromised information security. They are now among the most common sector targeted in these events
- Assume that it is not a matter of "if" I will be hacked/attached, it is simply a matter of "when"
- Modern hospitals are frequently a giant conglomeration of various IT systems that include modern components but also much older "legacy" systems that can be easily exploited as points of access
- Common points of entry are through individual users responding to phishing emails or links/downloads, networked devices with outdated software or security patches, or vendor systems that access the healthcare facility
- Cybersecurity and information/systems protection needs to be a priority focus of every hospital or healthcare system C-suite, and not treated as an afterthought or a delegated responsibility
- Cybersecurity and IT protection training should be mandatory for every employee or affiliate, and should be focused, robust, and responsive to the latest changes and techniques being employed to compromise your systems
- **EQUALLY IMPORTANT**, and consistent with item #2 above, there must be robust preparation and training for a successful cyberattack that takes down all critical hospital information and communication systems simultaneously.
- In addition to the hospital IT systems and data, assume that any personal/professional data on your individual work computer or other devices will be lost. Have a robust backup/duplication system to protect against this event.
- A successful attack can take down ALL of your systems and access, not just the EMR. You may lose access to medication dispensing, blood product dispensing/tracking, telemetry, pager systems,

- radiology systems, wired or wireless internet, and even the ability to log on to any hospital computer
- Preparation must include maintaining a large supply of paper charts, order sets, backup access to medication and blood product dispensers, and billing/coding sheets. Do not count on having these stored on a computer to be printed when needed as you may lose the ability to log on or connect to any networked printer.
- The healthcare industry is at a particularly high risk
 - The mandate to move to electronic records
 - The sensitive nature of health care data
 - The immaturity of the information security practices that exist in the health care industry today
 - The cost of compromise could range from an inconvenience to loss of life

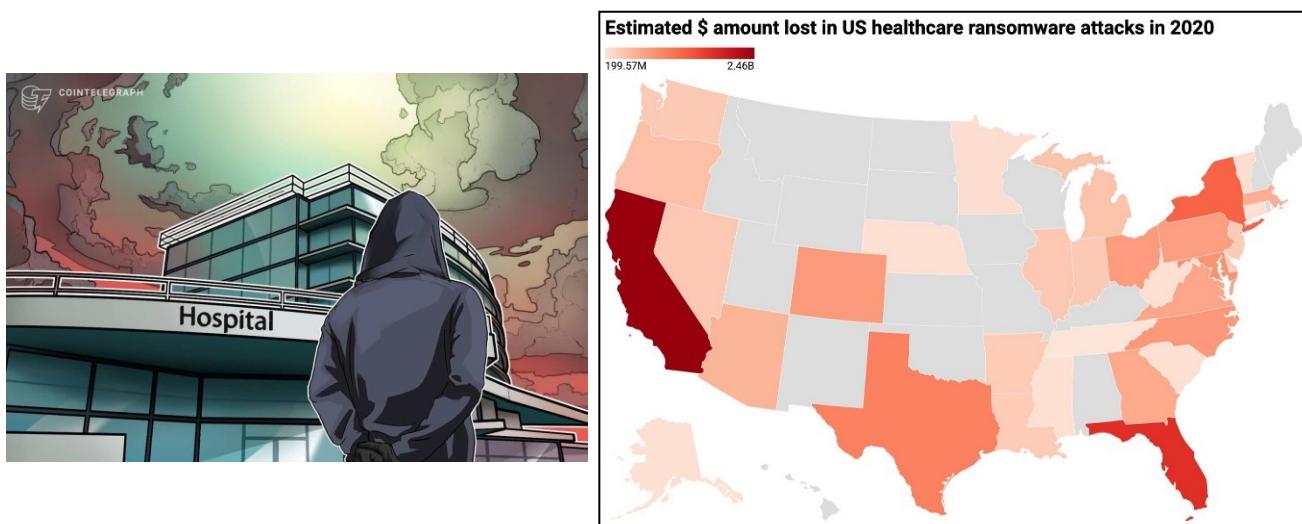


Figure 1.

FOLLOW THE MONEY \$\$\$

Medical Records are the crown jewel for hackers

Stolen Electronic Healthcare Records (EHR) can be sold on the darknet for up to \$1,000. By comparison, social security numbers and credit card information usually sell for \$1 and up to \$110, respectively [6]. EHRs contain information that is harder to cancel/recover once stolen (PII, insurance, policy numbers, medical diagnoses, billing information). This information is often used by fraudsters to create fake IDs, to purchase medical equipment or drugs, or to file a false insurance claim.

WHAT IS RANSOMWARE?

Ransomware is a specific form of malware that can assume control of an individual computer, computer network, and/or various peripherally networked devices and encrypt some or all personal information, documents, applications, and other items. Once successfully deployed, the users will no longer be able to access or unencrypt any of the affected folders, files, programs, or other involved items. In some cases, they may even lose the ability to log on to the affected device.

With the efficacy of modern ransomware encryption that is utilized, there is little to no chance of breaking the encryption or restoring the affected files, even by professional or government cybersecurity personnel. The only way to re-establish access and restore all affected files is to obtain the appropriate decryption key or program from the persons responsible for deploying the ransomware. The initial ransomware attack typically includes a file or a popup message that contains the “ransom note” including a demand for payment in exchange for the encryption key. It is important to note that there is no guarantee that the hackers will provide the encryption key even after payment of the demanded ransom.

Common ransomware demands are for payment of a specified sum to the responsible party or a third-party middleman, usually in the form of a secure cryptocurrency such as bitcoin (Figure below shows the NoCry ransomware demand). Common threats include permanent inability to access the data, deletion of the data, or public disclosure or posting of highly sensitive patient or corporate data.



Figure 2.

ANATOMY OF A RANSOMWARE ATTACK

There are a number of ways the ransomware code can gain initial entry to an individual device or a large network. The most common of these is via various types of phishing attacks involving infected emails, text messages, hyperlinks, malicious websites, or download files. These are often made to look like official messages, links, or files from well-known companies or websites, or even disguised as internal work-related business from executive leadership or Information Technology personnel. This has been a prime focus of awareness and prevention training. Alternate methods that may also be utilized, particularly when accessing large healthcare or other corporate systems involve exploiting weaknesses in existing systems or software to gain access to one node on the network. This may often be easiest via older or “legacy” systems that do not have the most up to date firewall and protections installed or that may not have maintained updated hardware or software patches. Files with ransomware or other malware may also be introduced via an infected device such as a USB flash drive, CD or DVD, or other data storage device. Thus, even a device that is not networked or even connected to an intranet or the internet can be infected with ransomware via this method. It can also be spread via a compromised ethernet or wifi system to any device that connects to that network.

At some point after gaining access to the targeted system(s), the ransomware will encrypt all targeted information, data, and files. This essentially converts them to unreadable code or text which cannot be opened, or which appear to be gibberish when opened. As shown in the figure below, the encryption process requires an encryption key, and the only reliable method to restore affected files is via the specific decryption key that is known only to the attackers.

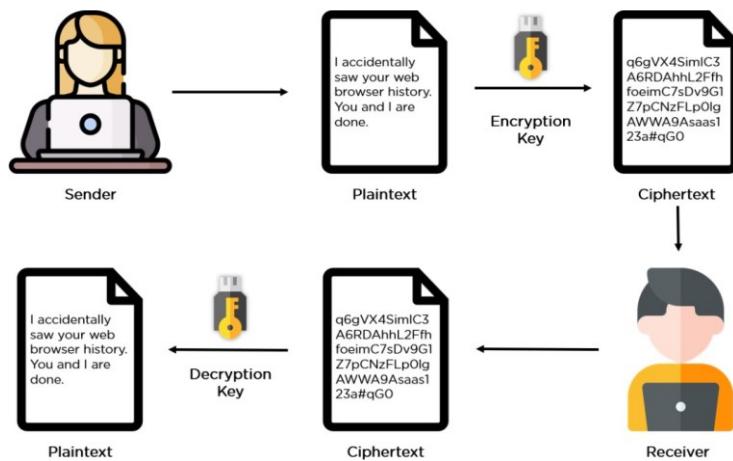


Figure 3.

Encryption is defined as “the conversion of data from a readable format into an encoded format that can only be read or processed after it's been decrypted”. Encryption is a key component of data protection and security that is widely used throughout the world by both individuals and business entities. However, the positive security features that make encryption a key component of data security can similarly be utilized by hackers to capture and control the victim's data.

The majority of ransomware utilizes asymmetric encryption methods. As shown in the figure below, this method utilizes both a public key and a private key that are mathematically related, and that are used to encrypt and then decrypt the data respectively. This has several security advantages over the symmetric encryption method in which the sender and receiver both have to have the same private key, and thus data security is dependent on the ability to securely store or send the decryption key.

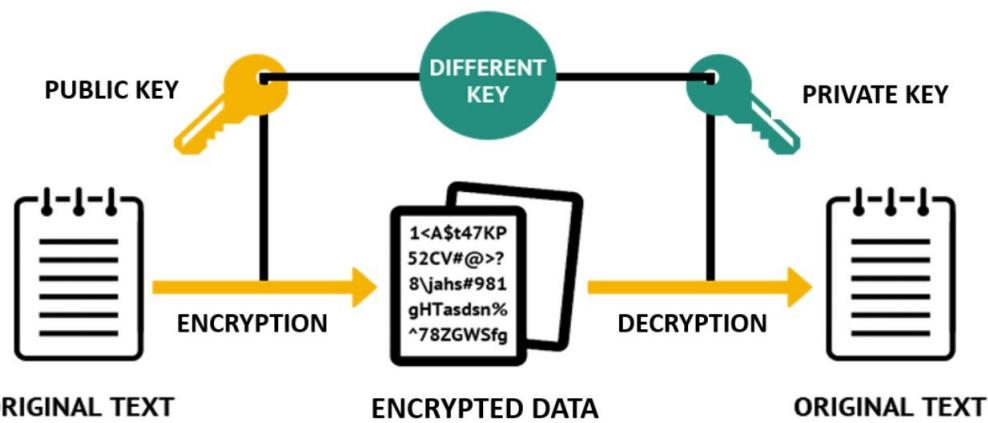


Figure 4.

One of the most important aspects of a ransomware cyberattack against a medical facility or healthcare system to understand is that the malware typically does not immediately activate and start to encrypt files. This would often result in it being quickly recognized and contained, thus limiting the scope and impact of the attack. The malware will take an inventory of the local files and folders to be attacked, but also will begin mapping the network and spreading to connected devices, servers, and peripherals. This can occur over weeks to months. It maximizes the effect and impact of the ransomware once it is deployed, ensures complete or near-complete control of the targeted network, and minimizes opportunities for the targeted center or system to make an effective early response or regain control of the network and critical data.

In addition to the above, there will be a critically important search to identify, access, and compromise any on-site or off-site backup servers. If the targeted center or system maintains a backup copy of its computer systems and critical data, then they could potentially avoid paying the ransomware and simply wipe and restore the affected systems. If the attackers are able to control and encrypt or delete these critical backup servers, then the victim will often have little option other than paying to retrieve their data and access to their information systems.

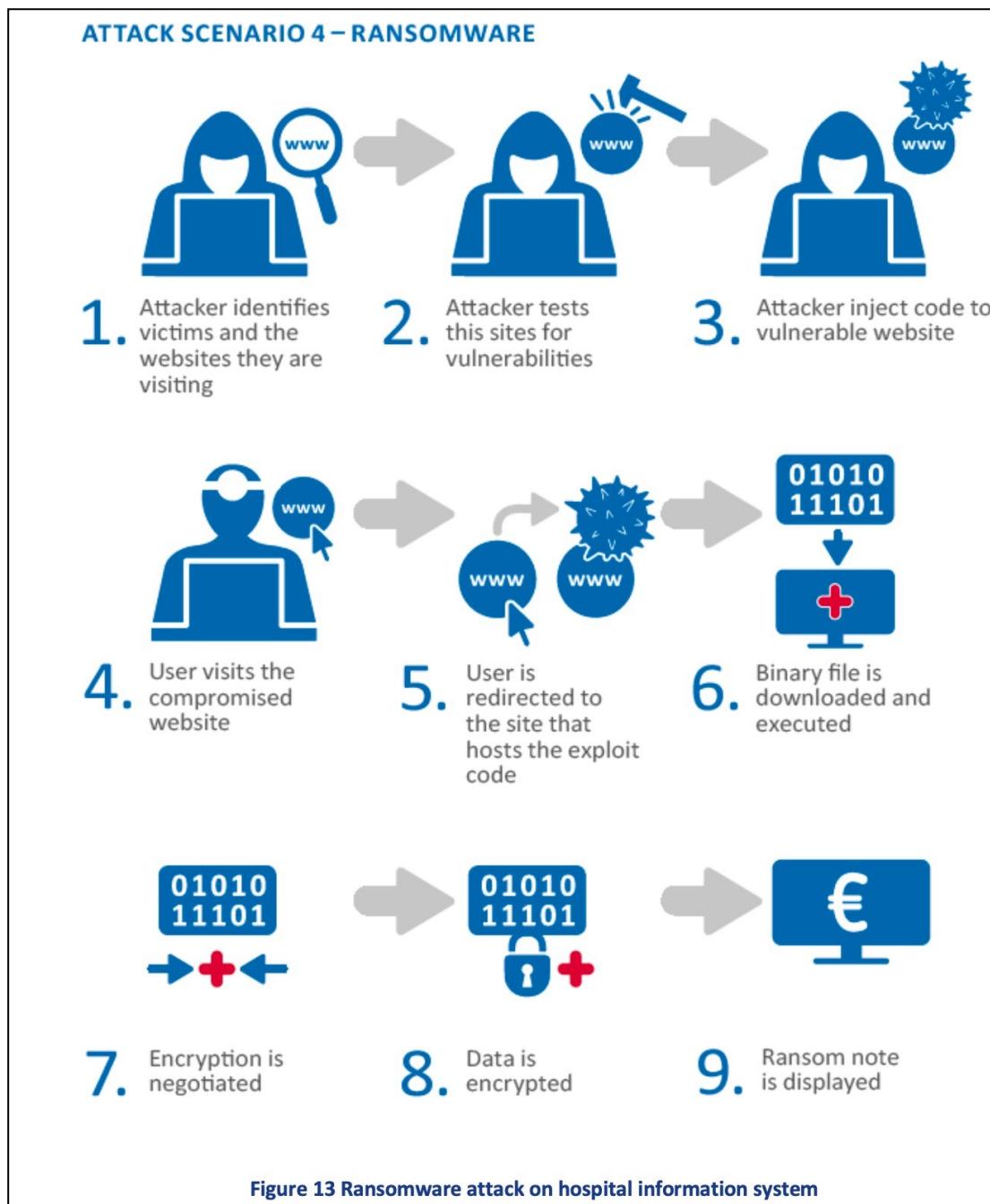


Figure 13 Ransomware attack on hospital information system

Figure 5.

TYPES OF CYBERSECURITY AND RANSOMWARE ATTACKS



Figure 6.

As shown in the figure above, ransomware is just one of the many types of cybersecurity attacks or threats that all healthcare organizations face in the modern era of information systems and connectivity. It is also important to note that these threats are often related and combined to achieve the desired effect. For ransomware, the point of entry is often obtained via other methods on the list including phishing, spam email, malware, or identity theft. Phishing attacks and information leakage (or identify theft) are the two most methods employed to initiate a ransomware attack.

Ransomware can be broadly grouped into two categories as shown below with their definitions. The non-encrypting or “locker” version is more commonly seen with attacks on individuals, and the encrypting or “crypto” type is by far the more common method utilized when attacking hospitals, healthcare systems, and any corporate or industry target. In an estimate from 2018 there were 350 different variants of ransomware described, representing a 150% increase from the year prior. These numbers have only continued to increase at a significant rate, and the variants continue to become more technically sophisticated over time. Another recent trend in the types of cybersecurity and ransomware attacks is the move to cloud-based solutions for data storage and backup by many healthcare organizations. This has predictably resulted in an increase in ransomware designed to exploit these cloud-based platforms in addition to in-house information systems and data backup/storage devices. Of great concern, 25% of healthcare institutions are not encrypting their data during transfer to the cloud, and 36% with data in a multi-cloud environment are not using encrypted technology.

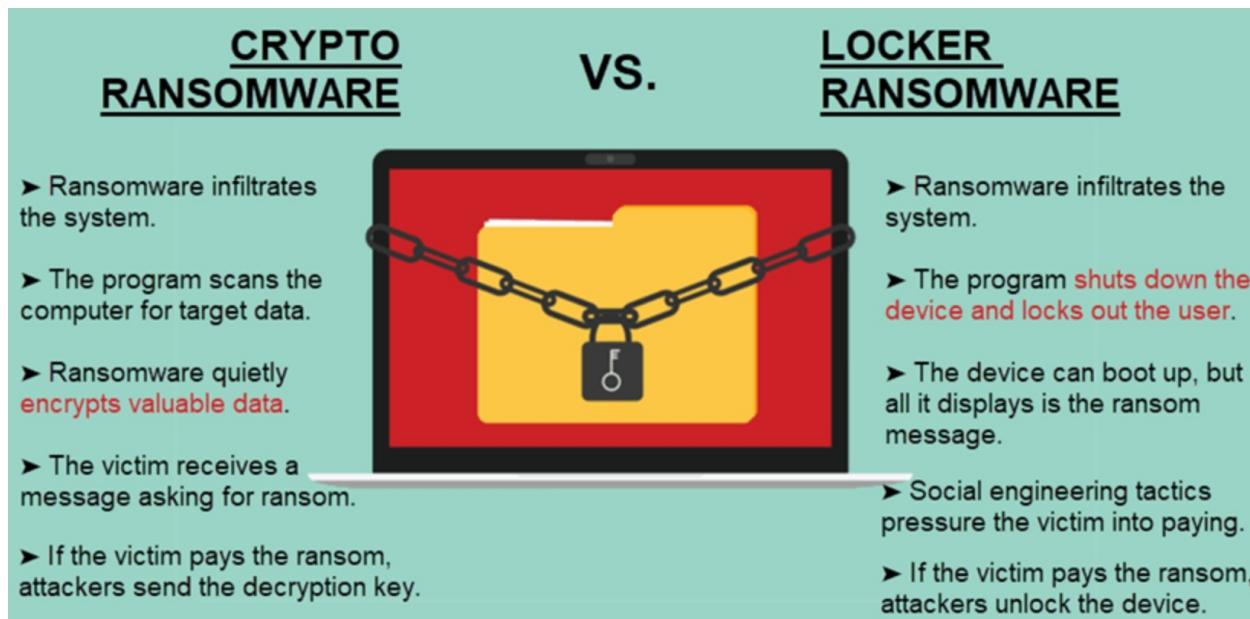


Figure 7.

HOW TO PREVENT SUCCESSFUL RANSOMWARE ATTACKS

Protection of IT systems and prevention of the deployment of ransomware or other malware is obviously far preferable to responding to a successful attack that has stolen and/or encrypted critical data and data systems. Although there are numerous specific technological practices and programs that should be implemented to prevent access to a center's IT systems by malicious actors or organizations, the most important preventive measures are arguably related to the institutional leadership and culture. The healthcare industry has been identified as one of the common sectors that continues to have lax or inadequate cybersecurity awareness, policies, training, and leadership. Even the most secure firewall and other technologic factors cannot overcome the "human-factor" of lax or non-existent security practices or even willful misconduct of employees that compromise the IT security.

Adoption of a universal posture of cybersecurity diligence from the top leadership through all levels of the organization and any affiliated personnel, vendors, and collaborative partners is the first and most important step to preventing successful cyberattacks and to limiting the damage or extent of any executed incursions. The majority of successful cyberattacks arise from compromise of security by an employee or affiliate, either unintentionally (via malware, identity theft) or intentional.

Some sobering statistics related to healthcare IT and cybersecurity:

- 42% leave cybersecurity in the hands of a vice president or C-level official
- 39% report biggest challenge is the lack of qualified IT employees
- 40% of small and medium organizations do not have dedicated staff to deal with cloud-based issues
- 61% cited senior-level executives as a high security threat due to their level of access privileges and lack of stringent cybersecurity practices and knowledge

11 Steps to Defend Against the Top Healthcare Cyberthreats

(from Dobran B, <https://phoenixnap.com/blog/healthcare-cybersecurity-threats>)

1. Consider threat entry points and vulnerabilities

2. Learn about ransomware attacks and likely targets
3. Create a ransomware policy and train for immediate response
4. Focus on employee cybersecurity and best practices training
5. Create or expand security measure risk levels and restrict access as appropriate
6. Go beyond employee access and factor in patient concerns and data access issues
7. Protect health data on ALL “smart” equipment and not just computers
8. Consider cloud migration for data storage and backup, transition to multi-cloud approach (Figure below) as appropriate
9. Ensure vendors are compliant with access, updated security, and threat detection
10. Educate employees on HIPAA regulations and compliance for data protection
11. Push a top-down security program and conduct regular risk-assessments

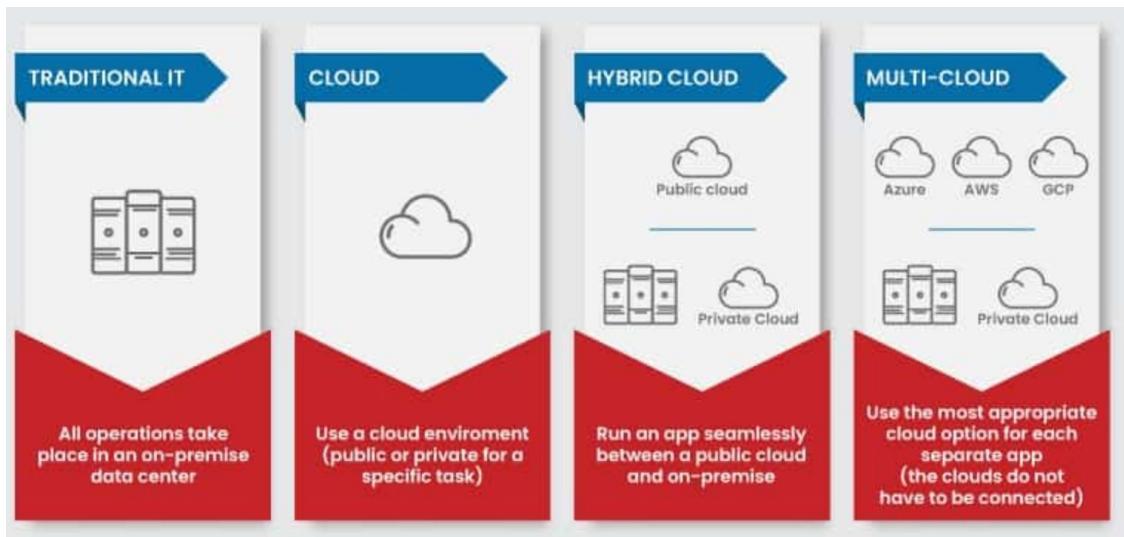


Figure 8.

ZERO TRUST SECURITY APPROACH

With the recognition that the majority of cyberattacks involve compromise of employee credentials, logon information, malware introduction, or purposeful sabotage, the Zero Trust Security approach has been developed. This involves a posture of never assuming that persons or devices attempting to access protected information are legitimate and implementing numerous checks and balances to confirm all identities, partitioning data and data-access, and continuously monitoring the network for any atypical or suspicious activity. This “default deny” posture results in systems that are hardened and isolated until a verified level of trust is established.

The Figure below shows the seven principles of implementation of a zero-trust model. This includes zero assumed trust in five areas: 1) employees or other people accessing the system, 2) devices and 3) networks that access or interact with the system,

4) data and data sharing, and 5) workloads (particularly running in the public cloud). The final two principles are visibility and analytics to continuously monitor and analyze every activity on the network, and automation and orchestration to enable automatic and coordinated incident response and task delegations during any cyberattack attempt or successful infiltration of the protected network.

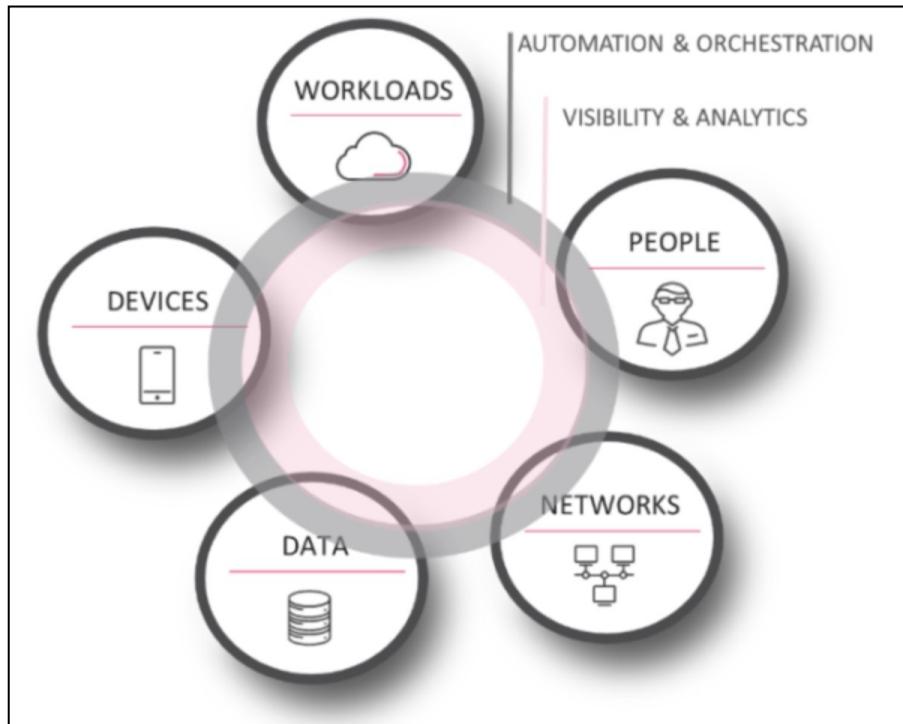


Figure 9. The Forrester Zero Trust Extended Security Model

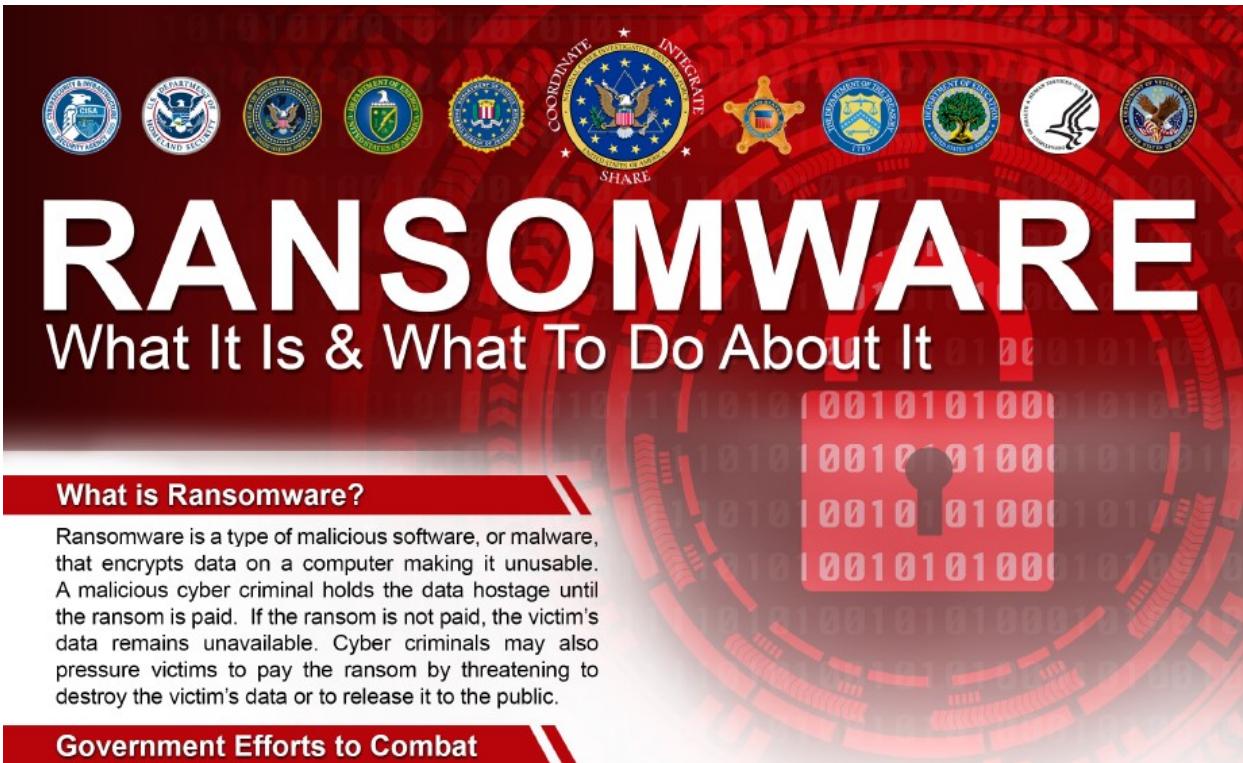
IMMEDIATE AND DELAYED RESPONSE TO RANSOMWARE

The immediate and delayed responses to ransomware are critical to preserve as much data and system operability as possible in the face of the cyberattack. The two immediate and simultaneous priorities should be disconnection of the device from the network and notification of the appropriate IT or cybersecurity personnel. The figure and expanded explanation table below highlights eight immediate and delayed actions that should be undertaken upon identification of an impending or executed cyberattack.



- **Isolation:** Isolate the infected system from the rest of the network. Shut down the device, pull out the network cable, and turn off the Wi-Fi to localize the problem.
- **Malware identification:** Next, determine what type of malware has infected the system. Either the IT team or an outside consultant should analyze and identify the threat.
- **Report the breach:** Even if some regulation does not oblige you to report an attack, authorities can offer expertise and insights the in-house team perhaps lacks.
- **Remove the malware:** Remove the malware by uninstalling everything on the infected device and reinstalling the operating system.
- **Analyze data loss:** Identify which data the attacker managed to encrypt. Also, search for signs of data exfiltration.
- **Recover data:** Once you contain the attack, restore data from the most recent backup available.
- **IT forensics:** Most hackers try to leave a back door in each system they infect. Ensure the team scans all IT environments for potential entry points.
- **Improve the system:** Determine how the intruder breached the system and make improvements to ensure the same attack does not happen again.

Figure 10.



RANSOMWARE

What It Is & What To Do About It

What is Ransomware?

Ransomware is a type of malicious software, or malware, that encrypts data on a computer making it unusable. A malicious cyber criminal holds the data hostage until the ransom is paid. If the ransom is not paid, the victim's data remains unavailable. Cyber criminals may also pressure victims to pay the ransom by threatening to destroy the victim's data or to release it to the public.

Government Efforts to Combat Ransomware

While ransomware attacks impact all sectors, the federal government is particularly concerned about the impact of ransomware on the networks of state, local, tribal, and territorial governments, municipalities, police and fire departments, hospitals, and other critical infrastructure. These types of attacks can delay a police or fire department's response to an emergency or prevent a hospital from accessing lifesaving equipment. To combat this threat, the NCIJTF has convened an interagency group of subject matter experts to educate the public on ways to prevent ransomware attacks, to improve law enforcement coordination and response, and to enable and sequence whole-of-government actions that impose consequences against the criminals engaged in this malicious activity. The Cybersecurity and Infrastructure Security Agency (CISA) leads a number of efforts including [CISA Cyber Essentials](#) and [CISA Insights](#) to assist entities in protecting themselves from cyber incidents like ransomware. More about these efforts and the tools CISA offers can be found at <https://www.cisa.gov/ransomware>. The FBI's IC3.gov website has additional ransomware focused resources that can be found at <https://ic3.gov/Home/Ransomware>.

Common Infection Vectors

Although cyber criminals use a variety of techniques to infect victims with ransomware, the most common means of infection are:

■ **Email phishing campaigns:** The cyber criminal sends an email containing a malicious file or link, which deploys malware when clicked by a recipient. Cyber criminals historically have used generic, broad-based spamming strategies to deploy their malware, though recent ransomware campaigns have been more targeted and sophisticated. Criminals may also compromise a victim's email account by using precursor malware, which enables the cyber criminal to use a victim's email account to further spread the infection.

■ **Remote Desktop Protocol (RDP) vulnerabilities:** RDP is a proprietary network protocol that allows individuals to control the resources and data of a computer over the internet. Cyber criminals have used both brute-force methods, a technique using trial-and-error to obtain user credentials, and credentials purchased on dark web market - places to gain unauthorized RDP access to victim systems. Once they have RDP access, criminals can deploy a range of malware—including ransomware—to victim systems.

■ **Software vulnerabilities:** Cyber criminals can take advantage of security weaknesses in widely used software programs to gain control of victim systems and deploy ransomware.

RANSOMWARE

What It Is & What To Do About It

Best Practices To Minimize Ransomware Risks

1. Backup your data, system images, and configurations, test your backups, and keep the backups offline
 2. Utilize multi-factor authentication
 3. Update and patch systems
 4. Make sure your security solutions are up to date
 5. Review and exercise your incident response plan

How Ransomware Has Impacted The Public Sector

The examples below may show the impacts in terms of ransom paid or service restoration cost, but it is difficult to calculate the total impact/costs of a ransomware infection. In addition, paying a ransom does not guarantee that stolen sensitive data will not be sold on the dark web.

- A U.S. county was infected by Ryuk, taking almost all of the county's systems offline. The county had backup servers, but they were not isolated from the network, allowing them to be infected as well. The county paid a \$132,000 ransom.
 - A U.S. city's systems were infected by Robbinhood with a ransom demand of 13 Bitcoins (\$76,000). The attackers entered the network through old, out-of-date hardware and software. The ransom was not paid, but service restoration was estimated to cost over \$9 million.
 - A U.S. county's computer systems were infected by Ryuk. The attackers demanded over \$1.2 million in Bitcoin for a decryption key. Officials decided to rebuild their systems rather than pay the ransom and spent \$1 million in new equipment and technical assistance. A user allegedly opened a malicious link or attachment which caused the infection.

Reporting Information

- The FBI does not encourage paying a ransom to criminal actors. Paying a ransom may embolden adversaries to target additional organizations, encourage other criminal actors to engage in the distribution of ransomware, and/or fund illicit activities. Paying the ransom also does not guarantee that a victim's files will be recovered. Regardless of whether you or your organization have decided to pay the ransom, the FBI urges you to report ransomware incidents to your local field office or the FBI's Internet Crime Complaint Center (IC3). Doing so provides investigators with the critical information they need to track ransomware attackers, hold them accountable under U.S. law, and prevent future attacks.

Victims of ransomware can file a complaint with law enforcement or report incidents by:

- Contacting your local federal law enforcement field office
 - Filing a complaint with the Internet Crime Complaint Center (IC3) <https://ic3.gov/Home/Ransomware>
 - Contacting NCIJTF CyWatch 24/7 support at 1-855-292-3937
 - Reporting incidents, phishing, malware or vulnerabilities with CISA <https://us-cert.cisa.gov/report>





EXPECTANT CARE: THERE IS NEVER NOTHING LEFT TO DO

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TOP THOUGHTS ON EXPECTANT CARE DURING DISASTERS AND MASS CASUALTY (MASCAL) EVENTS

1. Triaging patients and determining expectant status is likely the most ethically and emotionally challenging task you may ever encounter. Caring for an expectant patient, one who could have likely survived in an austere setting, may be just as emotionally challenging.
2. "Expectant" care does not equal "no" care. Providing high-quality end-of-life care requires experience, skill and some degree of emotional intelligence. If at all possible, it should NOT be relegated to the most junior member of the physician or nursing team.
3. While the patient is the primary focus of care, care should also be provided to the family (if present), the team and the surgeon (self-care).
4. As team leaders, not only are we ultimately responsible for the well-being of the patient, we are also responsible for the well-being of the team. One way to honor both the patient and the team is to utilize The Pause, a 15- to 30-second intentional moment of silence meant to provide closure to the relationship between the patient and the team.
5. Aggressive symptom management is often necessary at the end-of-life; multiple doses of multiple drugs of different classes (opioids, benzodiazepines, antipsychotics) may be needed at the same time. Such dosing may raise the concern of hastening death or euthanasia. One way to counter this concern is to utilize OBJECTIVE data (heart rate, blood pressure, nonverbal signs such as grimacing) to guide medication administration.
6. When the intention for using morphine is to relieve pain or dyspnea, the treatment is ethical, the risk of potentially dangerous adverse secondary effects which may lead to hastening death is minimal and the risk of respiratory depression is over-estimated.
7. Due to culture of surgery and trauma, team members may be at risk for disenfranchised grief, defined as the grief that persons experience when they incur a loss that is not or cannot be openly acknowledged, publicly mourned, or socially supported. Debriefing with colleagues can help to mitigate this risk.
8. The importance of self-care cannot be overstated. The importance of modeling self-care (whatever that looks like for you) for younger and less-experienced team members cannot be overstated as well.

INTRODUCTION/OVERVIEW

During a MASCAL or disaster event, patients who sustained injuries that make them unlikely to survive given the available resources are deemed expectant. While deaths in the trauma bay are often some of the most memorable, dramatic and traumatic experiences for all involved, they usually occur following either a heroic attempt to save a life or after the family accepts (or at least acknowledges) a devastating prognosis and agrees to transition to a comfort-focused approach. In contrast, deaths during MASCAL or disaster events (if not caused by the initial event) can occur due to a significant shortage of resources that may significantly alter the intensity of care available to a given patient. While an in-depth discussion of

triage is outside the scope of this talk, suffice it to say that patients who are declared expectant may represent deaths that would not occur under “normal” circumstances. This fact can add another layer of suffering to both the patient and to the caregiver. In disasters and MASCAL events, the patient is obviously the primary focus of care, but there are also various opportunities to provide care for the family (if present), the care team and the self.

TWO PRIMARY GOALS: ABSENCE (OF SUFFERING) AND (RADICAL) PRESENCE

When caring for an expectant patient, the goals of care are Absence and Presence.

The first goal is Absence of Suffering. As stated above, depending on the injury, trauma patients at the end of life may require high doses of various medications, often administered multiple times in rapid succession. This type of care requires skill, experience, a willingness to communicate openly with team members (including the pharmacist pulling the medications and the nurse administering the medications) and, hopefully, a pre-existing order set (see example below).

| | |
|-------------------------------|---------------|
| Patient Name: | ID Number: |
| Admit to: Expectant Care Area | |
| Diagnosis: | |
| Status: DNR/DNI | |
| Physician: | Pager number: |

Medications:

1. Morphine sulfate 5mg/10ml (100 mg in 200 ml)
step 1: 5 mg iv push q5 minutes until comfort or respiratory rate < 20
step 2: Start drip, hourly rate at the dose required to achieve comfort in step 1
step 3: If pain or distress, return to step 1 and treat anxiety as in #
2. Midazolam (Versed)
step 1: 2-4 mg iv push q30 minutes for anxiety/agitation
step 2: if continued agitation or frequent dosing, start drip at 4mg/hr and titrate
3. Haldol 5-10 mg q10 minutes for continued agitation
4. Albuterol nebulizer q2 hours for wheezing
5. Scopolamine patch 1.5 mg topically BID as needed for secretions
6. Glycopyrrolate 0.1 mg iv q1 hrs as needed for secretions

Treatments:

1. Titrate oxygen for sats > 92% with maximal support of non-rebreathing mask
2. If intubated, extubate when pain and agitation control achieved as above
3. Stop any previously ordered labs or blood draws
4. Stop any previously ordered radiologic studies
5. Change IV fluids to Normal Saline at 10-20 cc/hr as a driver
6. Remove any unnecessary tubes or lines – nasogastric tube, central lines, etc.
7. Turn off all monitor alarms in the patient’s room or area
8. Discontinue visiting hours, family/friends to be present as requested
9. Maintain comfortable environment – quiet, temperature, lighting, positioning
10. Call MD for resp rate > 30, discomfort, agitation, or anxiety not controlled by medications
11. Notify chaplain or other religious support as requested by patient or attendants
12. Notify physician and Patient Administration of patient death

From Rush RM et al. *Frontline Surgery: A Practical Approach*.

Several issues may arise. One, team members may question (either out loud or to themselves) the ethics involved in the dosing regimen. Two, team members may express (or may feel but not express) discomfort in administering high doses of medications. Three, the patient may continue to suffer from either pain, dyspnea, anxiety or agitation despite our medications.

While the best way to address these potential issues would be for an experienced surgeon to remain at the bedside, this is not likely possible during a disaster or MASCAL event. That being said, expectant care does NOT equal no care and so the surgeon should take a moment to discuss any questions or concerns. In order to assist the nurse in deciding when to administer medication, the surgeon can suggest certain objective parameters, such as heart rate, respiration rate, facial grimace or agitated body movements, be utilized to decide when the next dose of medication is needed. Lastly, if the patient continues to suffer, the surgeon should be available to change the plan of care.

Much has been written about the idea of “double effect” and the actions of morphine at the end of life. However, Dr. Charles von Gunten, a pioneer in the field of palliative care, has written extensively about this topic and notes that the adverse effects of morphine (including respiratory depression) are actually over-estimated. He notes that the principle of double effect actually refers to the ethical construct where a physician uses a treatment where the potential outcome is good, knowing that there will certainly be an undesired secondary outcome (he uses the separation of conjoined twins as an example, when the physician knows that one will leave and one will do). Instead, he states that the potential side effects of morphine can be considered unintended consequences, which, again, are over-estimated.

If the patient is conscious, they may have a sense that they are dying and may, in fact, ask you. This question should be answered compassionately and truthfully. While an honest answer may lead to more suffering (particularly emotional and spiritual), it will also offer the patient an opportunity for closure. In order to address any emotional or spiritual suffering, we should also ask the patient if they would like a chaplain to be called.

The second goal during this time is Presence. Dr. Balfour Mount, a urologic oncologist who coined the term “palliative care” and who is considered the Father of Palliative Care in North America, has spoken and written about the idea of Radical Presence, the willingness and ability to be full present with another being in their suffering and in their dying. While this concept may sound like new-age mumbo jumbo, I would counter that there is nothing more “hard core” than holding space for someone as they contemplate their mortality and take their last breaths and nothing more “hard core” than sitting still and just experiencing the moment instead of trying to fix or to change the ultimate outcome.

CARING FOR THE FAMILY

The first step in caring for the family is to ensure that family members receive a timely, accurate update from the trauma team, ideally by a senior member of the team who has experience in communicating serious news. While the trauma team is very busy, it is worthwhile to take a few moments to plan the interaction, checking to see if any other specialist wants to be available (for example, the neurosurgeon in the setting of a devastating brain injury) and making certain to find a quiet place for families to sit (with tissues available). While this update is occurring, other members of the team should be cleaning the patient and the room so that family members are not unnecessarily exposed to traumatic sights. It is often helpful to start the conversation by asking the family what they know and then firing a “warning shot” (for example, “I am sorry that I have bad news” or “I am afraid that I have some serious news”). When discussing death or an impending death, it is best to use the D word (died, dying, death) so that there is no confusion on the part of any family members.

Once the family is updated, they should be invited back to be with the patient. The vast majority of family members will have little to no experience with death and dying. If time allows, a member of the trauma

team should be available to curate the experience. Even in the emergency room, the ideas of set (preparation and expectation of the person or people having the experience) and setting (the physical and cultural environment in which the experience takes place) often discussed in psychedelic culture, are relevant. As far as set, family members should be quickly educated about the signs and symptoms of imminent death. In terms of setting, the trauma team member may choose to dim the lights, play the patient's favorite music, encourage the family members to touch and talk to the patient, invite the family members to share stories about the patient, and even ask, if it seems appropriate, who may be waiting to welcome the patient on the other side. Allowing family members to take an active role during the patient's death may assist with the grieving process.

That being said, we know that unexpected or violent deaths can increase the risk of Prolonged Grief Disorder (sometimes referred to as complicated grief). Symptoms of the disorder include: intense sorrow, pain and rumination of the deceased; an inability to focus on little else but the death; extreme focus on or avoidance of reminders of the deceased; problems accepting the death; and an inability to enjoy life or think back on positive experiences with the deceased. Further, in his book "Retelling Violent Death," Edward Rynearson addresses the two distinct, but intertwined, distresses that survivors of violent loss experience: traumatic distress and separation distress (see Figure below). He notes that "the thoughts, feelings and behaviors of simultaneous traumatic and separation distress are not harmonious" and that their contradictory nature makes them difficult to process. Preparing a handout which contains information about complicated grief and the distinct difficulties of violent loss, along with contact information for local trauma-informed therapists, the Trauma Survivors Network and your contact information in case families have questions is another way to support families during this challenging time.

| | Traumatic Distress | Separation Distress |
|----------|--|---------------------------|
| Thoughts | Reenactment of Dying | Reunion with the deceased |
| Feelings | Terror | Pining and Sorrow |
| Behavior | Avoidance of reminders of the dying Protection of self and others | Searching |

From: Rynearson, EK. *Retelling Violent Death*.

CARING FOR THE TEAM

While trauma surgery is a team sport, the trauma surgeon is the "captain of the ship" and bears the ultimate responsibility for the care of both the patient and of the team. As stated earlier, expectant deaths can be especially difficult to process when faced with the knowledge that the death may not have occurred in an austere environment. Ultimately, it is up to the trauma surgeon to clearly communicate what happened, what could be done better and what was simply unavoidable given the current circumstances.

As stated earlier, one way to care for the team is to make certain that a senior team member is present or immediately available during the dying process. Once the death occurs, Jonathan Bartels (a former trauma nurse and now a palliative care nurse) suggests performing The Pause (see Figure below), an intentional 15- to 30- second moment of silence meant to honor the life of the patient and the work of the trauma team as well as to provide closure to the relationship between the patient and the team.

All team members, including the attending surgeon, may be at risk for disenfranchised grief, defined as “the grief that persons experience when they incur a loss that is not or cannot be openly acknowledged, publicly mourned, or socially supported.” The best way to counter this risk is to acknowledge one’s feelings in a safe space, and to encourage others to do the same.

The screenshot shows the homepage of The Pause Guidelines website. At the top, there is a logo consisting of a stylized 'O' shape followed by the text "The Pause Guidelines". Below this, a large heading states: "The purpose of The Pause is to honor a patient and the caregiver team. It is a 15-30 second period of silence shared by caregivers after a patient's death. The Pause provides closure to the relationship between the caregivers and the patient, preparing the caregiver team to care for other patients." Underneath this, a section titled "Key Points to Remember:" lists ten bullet points. The footer of the page features a teal navigation bar with four items: "Home" (with a house icon), "Guidelines" (with a book icon), "Experience" (with a speech bubble icon), and "About" (with an info icon).

The purpose of The Pause is to honor a patient and the caregiver team. It is a 15-30 second period of silence shared by caregivers after a patient's death. The Pause provides closure to the relationship between the caregivers and the patient, preparing the caregiver team to care for other patients.

Key Points to Remember:

- **Begin by asking the team and/or family if it would be ok to take a moment and honor the patient.**
- **If the family or members of the care team have questions or concerns, please show them the app.**
- **It is 100% ok if someone prefers to opt out of the experience and leave the room.**
- **The Pause is a practice that allows one to honor in silence and in a way that gives meaning.**
- **Participation is voluntary.**
- **The Pause is usually performed at the bedside, but may be performed in another location depending on the situation.**
- **Anyone can lead The Pause and any caregiver can participate.**

CARING FOR THE SURGEON/THE SELF

Rene Leriche wrote that “every surgeon carries within himself a small cemetery where from time to time he goes to pray – a place of bitterness and regret, where he must look for an explanation for his failures.” How successfully we can incorporate that cemetery into the landscape of our lives depends, in part, on how much we prioritize caring for our physical, mental, emotional and spiritual well-being. This will, of course, look different for every surgeon. Perhaps one of the best things that we can do is to model this behavior for our all team members so that they, too, recognize the importance of self-care.

SUGGESTED READINGS/REFERENCES

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LOCATION, LOCATION, LOCATION: RAPID HOSPITAL EXPANSION LESSONS FROM THE COVID EXPERIENCE

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SUMMARY POINTS

1. Traumatic injury (in particular interpersonal violence) increased exponentially in Philadelphia and around the US
2. Incidence of gun violence appeared to be most prominent in neighborhoods worst affected by COVID infection
3. Highlights importance on preparation of surgical/trauma capability even in a primarily “medical” pandemic
4. Early trauma/surgical representation at high-level hospital organizational meetings is crucial.
5. Regional trauma system cooperation is important – in areas with more than one hospital system providing trauma services, early and regular discussions of a rapidly evolving clinical situation is key.
6. The ACS-CoT recommends developing a regional medical operations center to achieve this communication
7. Individual trauma centers should consider the following adaptations to their response:
 - a. Early identification of patients likely infected with COVID
 - b. Early testing and masking of trauma patients when feasible
 - c. Modifications to the trauma resuscitation area to minimize exposure
 - d. Ensuring PPE guidance is in accordance with hospital infection-control standards
 - e. Limiting numbers of personnel on the trauma team
 - f. Having a backup tier of trauma staff to allow for staff sickness/quarantine
 - g. Training non-trauma surgical staff in trauma techniques
 - h. Expanding ICU space by repurposing PACU and ORs
 - i. Continuing education through use of virtual learning

CONTEXT

The COVID-19 pandemic has stressed all facets of healthcare delivery. Although social distancing measures and travel restrictions likely reduced injury rates across the United States, penetrating trauma in some metropolitan centers, including Philadelphia, increased.

Trauma centers serve as regional resource sites for high-acuity patients; so careful planning is required to maintain access to trauma care during an infectious pandemic.

Guidance from the American College of Surgeons Committee on Trauma (ACS-COT) provides a general framework for the pandemic response, but these precepts must be contextualized to local and regional factors.

VOLUMES

Understanding volume changes in trauma activations is important in ensuring appropriate adjustment to resource availability and in planning discussions with hospital leadership. In our trauma system, we evaluated the volume of trauma in the first 6 weeks of the pandemic compared to the same period one year previously.

Our experience in Philadelphia shows total trauma contacts decreased from 1,328 at baseline to 1,058 in the COVID period (net -20.3%). However, the proportion of trauma alerts increased across the city (29.1% baseline vs. 34.5% COVID, $p = 0.006$) due to an increase in both the absolute number (233 vs. 251) and proportion of penetrating trauma patients (17.5% vs. 23.7%, $p < 0.001$).

By individual trauma center, median total trauma contacts decreased from 244 (interquartile range [IQR], 138–272) at baseline to 190 (89–238) in the COVID period ($p = 0.036$).

We also compared locations of 187 individual shooting events in Philadelphia during the pandemic to the distribution of confirmed COVID-19 infections by ZIP code, adjusted for population (Fig. 3). High-density COVID ZIP codes had significantly more shootings per 10,000 individuals compared with low-density COVID ZIP codes (1.3 [0.6–1.8] vs. 0.4 [0–1.2], $p = 0.022$).

These trends were also reflected in other major urban cities across the United States.

MAINTAIN TRAUMA CENTER ACCESS

It became clear that there are competing priorities: our initial impression was that surgical services in particular critical care would be repurposed to assist the surge of critically ill medical patients with COVID-19. However, the trauma volumes clearly indicated a need to maintain trauma center readiness.

In Philadelphia, there are four level 1 adult and 2 level 1 pediatric trauma centers. In the first 6 weeks of the pandemic, in anticipation of this surge of critically ill COVID-19 patients in parallel with the continued high acuity trauma volume in our city, our Level I trauma centers and trauma programs individually implemented a number of structural and operational changes to maintain trauma access and to protect our trauma team members.

These included:

a. Workforce Planning

Integrate trauma representative into Incident Command Structure

Meet weekly with regional TMDs and TPMs

Train non-trauma general surgeons to augment critical care services

Expand anesthesia role to support Emergency Department intubations

Streamline trauma teams to balance clinical coverage while minimizing exposure

Activate reserve team members as needed to support high-volume clinical activity and to backfill staff quarantining/illness

Integrate telemedicine into bedside rounds and specialty consults with limitation of in-person visits to essential assessments (e.g. tertiary survey)

Dedicated teams perform high-demand procedures (e.g. vascular access, tracheostomy)

b. Trauma Bay and Resuscitation Changes

Screen and/or test patients for COVID-19 during intake and trauma resuscitation

- Add physical barriers to isolate bays
- Designate specific bays for use by COVID-confirmed or suspected patients
- Convert patient assessment areas to negative-pressure if possible
- Designate specific areas for donning and doffing of PPE
- Remove unnecessary equipment
- Limit personnel in the trauma bay to essential personnel only
- Perform critical procedures by most experienced care team member
- Perform AGPs (including intubation) in the trauma bay prior to transport
- Employ in situ simulation to reinforce workflow and procedural changes

c. Radiology Protocols

- Limit imaging to decision-critical studies as much as possible
- Examine for findings consistent with COVID-19 infection on chest imaging

d. Operating Room Changes

- Transport to OR by most direct route with staff in appropriate PPE
- Designate specific operating room(s) with negative-pressure capability for COVID-confirmed or suspected patients
- Convert existing ORs to negative-pressure capability if possible
- Minimize personnel traffic in the OR
- Designate “clean” runners outside the OR to obtain needed equipment and supplies
- Consider reconfiguring OR rooms to augment PACU/ICU capacity
- Operating and anesthesia team members wear appropriate PPE during AGPs

e. Blood Product Utilization

- Collaborate with national organizations (e.g., American Red Cross) to sponsor blood donation drives
- Limit nonemergent transfusions to preserve supply
- Limit use of rare blood types

f. Education and Training of Housestaff

- Convert educational and working conferences to teleconference format
- Incorporate housestaff into procedural teams to maintain and bolster technical skills
- Record and disseminate in-situ simulation for training

These changes fell broadly in line with both ACS guidance and recommendations based upon experiences of other national and international centers. To further address the unprecedented threat from the pandemic, our centers quickly established a broader regional virtual working group to assist in maintaining trauma center readiness. This allowed a unique forum to maintain our situational awareness and to adapt and coordinate our response.

One additional modification we made regionally was to utilize our pediatric trauma centers as pop-off valves for the adult centers. Philadelphia has two Level 1 pediatric trauma centers that typically do not accept patients over the age of 19 years. We developed a plan to transfer younger adults (age, 17–25 years) to the pediatric trauma centers as needed. This agreement created a virtual buffer for our adult centers that would facilitate continued trauma access for activations and transfers-in should capacity be reached or exceeded. Any patients transferred to pediatric centers would have potentially benefitted from a more permissive visitation strategy and additional social work resources.

TAKE-HOME POINTS

Likely due to multifactorial reasons including an increase in gun sales, socio-economic disadvantage, and pre-existing health disparities, there has been an observed increase in primarily penetrating trauma volume across the United States. This trend looks to continue.

It provides important insight that planning for public health emergencies must take into account the need to maintain trauma-center readiness. This includes systemwide and regional discussion, integration into hospital incident command structures, and local changes to ensure continued high-quality care while maintaining a safe working environment for patients and staff.

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WHOLE BLOOD: THE IDEAL PRODUCT FOR MASS CASUALTY EVENTS?

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There has been an explosion at a local chemical refinery in your community. The initial reports indicate that the hospitals should expect to receive approximately 80 casualties, 15 of whom are considered critical. Fortunately, you have prepared for this type of an event. As you mobilize resources for this mass casualty incident, some thoughts enter your mind. Will we have enough blood products for the casualties? Could a walking blood bank could have been planned to provide fresh whole blood?

What are the blood product needs for civilian mass casualty events (MCE)?

How can we assure that blood products are available to meet casualty needs?

UP-FRONT TAKEAWAY: Yes, whole blood (especially fresh warm) is an ideal product for MCEs. However, the pre-planning and logistics to accomplish this are substantial. In preparation for a mass casualty event, communities should first acquire routine experience with a whole blood program, then look for ways to expand this to the catastrophic situation.

WHAT ARE THE BLOOD PRODUCT NEEDS IN A MASS CASUALTY EVENT?

Understanding and predicting the need for blood products in a mass casualty event is difficult. Some information is available through analysis of historical events, though this becomes difficult to translate into the contemporary era of “hemostatic resuscitation.”

Following the terrorist attacks on September 11, 2001, the executive branch of the federal government made a plea for volunteers to donate blood. The result was that more than 475,000 units of blood were collected nationwide for the disaster victims, though only 285 units were transfused¹. In a commentary following 9/11, Dr. Paul J. Schmidt reported on a quarter-century of major U.S. disasters. He found that, in every case, the blood that was needed was immediately available with the existing supply. Prior to the September 11 attacks, there were four mass casualty events where more than 100 units of blood were transfused. To summarize the blood usage in each of these events:

| Year | City | Event | Casualties | | Blood Products | | |
|------|---------------------|------------------|------------|--------------|----------------|-----------|------------|
| | | | Killed | Hospitalized | On hand | Collected | Transfused |
| 1981 | Kansas City | Hotel collapse | 114 | 188 | 2500 | 1500 | 126 |
| 1989 | Sioux City | Plane crash | 111 | 185 | 713 | 602 | 119 |
| 1995 | Oklahoma City | Bombing | 167 | 83 | N/A | >9000 | 131 |
| 1999 | Denver | Shooting | 15 | 30 | 1924 | 1700 | 105 |
| 2001 | NYC + Washington DC | Terrorist attack | 2996 | 200 | N/A | >475,000 | 258 |

In each event, the existing blood supply in the community was enough to meet the needs of the casualties.

After a major disaster, calls for blood donation are common. On one hand, this is well-intentioned and appeals to the altruistic nature of people who want to help; it gives the volunteers a sense connectedness to the injured community. On the other hand, these donations, *because of blood banking practices and testing*, aren't available for use for a minimum of 2-3 days. This is beyond the time when the casualties need the transfusions. The donations do, however, serve to replenish the local supply.

Dr. Eric Frykberg commented on a 2005 report about the 2004 terrorist bombings in Madrid, "It is well established that very little blood is needed in these disasters; again, only a small minority are critically injured, and only a small percentage of these ever need blood."²

In 2013, Glasgow, et. al., published a comprehensive report detailing blood product usage during civilian mass casualty events.³ Over a 100-year period (1911-2011), 51 events were identified where blood product usage was documented. This analysis revealed several findings:

- Median number injured per MCE: 55 (interquartile range [IQR] 42-195)
- Median number cared for at hospital: 38 (IQR 23 – 158)
- Median red blood cell (RBC) use per event: 38.0 (IQR 15.5 – 137.5)
- Median RBC use per severe casualty: 5.9 units (IQR 4.0 – 8.2)
- Between 62 – 74% of RBC requirement in the first 24 hours was within the first 4 hours
- 27% of all RBCs transfused per event were type O

To summarize, the authors state, "the majority of RBC transfusions are therefore delivered within the first few hours of an event, and there is a heavy reliance on uncrossmatched blood during this acute phase of the response."

The authors then note that there has been a change in resuscitation strategy over the past 15 years, with current "hemostatic" or "damage control resuscitation" (DCR) strategies requiring a higher volume of non-RBC components. These components – plasma, platelets, cryoprecipitate – are typically not as readily available in volumes necessary to match the RBC component. Ensuring adequate supply of these components should be considered when planning for a mass casualty event. Using one historical example presented above – the 1981 structural collapse at a Kansas City hotel, where 126 units of RBC were transfused along with 23 units of plasma, and 32 units of platelets – and additional 103 units of plasma, and 94 units of platelets would have been needed to achieve a 1:1:1 transfusion ratio. This need for additional components challenges the notion that the existing blood supply would be adequate to meet the needs in a mass casualty event.

This reality – that modern blood product resuscitation requires balancing of components that wasn't addressed in older analyses of MCE-related transfusions – introduces the concept that whole blood would be the ideal product for a mass casualty event. Stockpiling the necessary plasma and platelet components for an MCE would produce an unacceptably high amount of product wastage, especially of the platelet component. As explained by Doughty, et. al., "fresh whole blood not only addresses the concerns about the storage lesion, but also provides a supply of both liquid plasma and a small dose of platelets with less anticoagulant than component therapy."⁴

WHOLE BLOOD AND A WALKING BLOOD BANK

Any discussion about use of whole blood needs to begin with a brief reminder of the different types of whole blood⁵.

Warm Fresh Whole Blood (WFWB): This is blood that has been drawn from donors who have, generally, been pre-screened for blood type and tested for pathogens. It is transfused immediately or within 4-6 hours. This blood is not subject to the "storage lesion," a progressive biochemical and biomechanical

change in RBC that occurs during storage. WFWB does not undergo full pathogen testing prior to transfusion. Because of this, *WFWB is not presently FDA-approved for civilian use.*

Cold Fresh Whole Blood (CFWB): This is blood collected as above, though not transfused immediately while warm. It is stored at 22° C for 8 hours or for an additional 24-40 hours at 4° C and transfused within 48 hours. This product, also, does not undergo full pathogen testing prior to transfusion and *is not presently FDA-approved for civilian use.*

Cold Stored Whole Blood (CSWB): This is blood collected as above, then stored at 1-6° C. Depending on the storage solution, it has a shelf life of 21 to 35 days. Because it is not immediately transfused, it is fully tested for pathogens and may be transfused to type-specific individuals, minimizing the risk of hemolytic transfusion reactions. This product does NOT have the same hemostatic potential as does WFWB and additional platelet supplementation may be required. It is also susceptible to the storage lesion.

Low Titer group O Whole Blood (LTOWB): This is cold stored blood that has been collected from blood group O donors who have low titers of anti-A and anti-B antibodies in their plasma. Because it is Type-O, ABO matching is not required for transfusion (universal donor); the low titers of anti-A and anti-B antibodies are necessary to minimize the risk of a hemolytic transfusion reaction when transfused to ABO-incompatible recipients. It is fully tested for pathogens and is FDA-approved for civilian use. *This is the product that is most commonly available and used in civilian trauma center whole blood programs.*

It is unlikely that LTOWB can be practically available in sufficient quantities to meet the transfusion needs of casualties in a mass casualty event, as maintaining a supply of this product would lead to an unacceptably high rate of wastage and would divert donated blood from separation into components for conventional (non-traumatic) use. A “walking blood bank” could serve as a supply of emergently needed warm fresh whole blood for emergency use in such a situation. But how could something like this be organized?

A walking blood bank is a pre-selected and pre-screened group of healthy donors who can be rapidly mobilized in real time to provide for immediate transfusion needs^{6,7}. The practice is well-established in the military sector, where fresh whole blood is obtained from soldier donors and immediately transfused in the far-forward environment. Additionally, one US-based cruise line ship has used a similar program for more than a decade.

A model for development of a walking blood bank program has been described in southwest Texas. The Southwest Texas Regional Advisory Committee (STRAC) provides trauma management services in 22-county area that is served by 2 Level-1 trauma centers, 3 Level-3 trauma centers, 25 Level-4 trauma centers, and numerous prehospital EMS agencies.

STRAC has a fully developed whole blood program. This program uses a product rotation system for the whole blood that ensures that LTOWB is available throughout the region, including with prehospital EMS units, while minimizing wastage of the whole blood units. There is, therefore, considerable experience with routine collection, distribution, and use of whole blood in the region. At any given time, there are approximately 30 units of LTOWB available across the system. This supply is maintained by a group of O-positive male donors who have been identified as having low titers (<1:256) of anti-A and anti-B antibodies. There are approximately 4000 such donors, 400 of whom donate frequently, who participate in this program known as “Brothers in Arms.”

The plan for the walking blood bank builds upon this experience. With 30 LTOWB units immediately available, this stock can be immediately gathered and delivered by helicopter to a mass casualty event location to be used for immediate transfusion.

In the situation of a larger scale event, the walking blood bank is mobilized. The “Brothers in Arms” are notified by text message and asked to present to their local blood collection center, where they are evaluated for eligibility for donation of emergency use whole blood. If the pre-screened donor has donated twice in the preceding 6 months (which would have been accompanied by full pathogen testing) and has had no change in risk factors, this **warm fresh whole blood** is made immediately available for transfusion. Pathogen testing is then completed after transfusion and a safety monitoring system is in place. This plan creates a potential for several hundred units of low-risk WFWB to be made available at a time when casualty needs exceed the existing supply of LTOWB. Again, note that this WFWB would be transfused in an emergency use situation, as there is no FDA approval for such.

SUMMARY

We have an evolving understanding of transfusion needs during a mass casualty event. While it previously appeared that blood usage was relatively low and that existing local resources could meet the needs, our current damage control resuscitation strategy makes it unlikely that adequate plasma and, especially, platelet supplies will be sufficient in times of a disaster. Whole blood satisfies the transfusion requirements for casualties. Communities are encouraged to develop a LTOWB program for routine use in care of injured people. This experience can then be built upon to plan a walking blood bank to supply WFWB in the time of overwhelming need.

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HOSPITAL EVACUATION DONE RIGHT

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The potential hazards necessitating hospital evacuation are ever increasing. Hospitals and Health Systems must be prepared to respond to these threats to ensure patient and staff safety as well as community resiliency.¹ Hospital evacuation is not an uncommon event. A recent publication noted 158 published hospital evacuations from 2000-2017, but this underestimates the extent of the problem. More than 35 hospitals were evacuated in 2017 alone in response to Hurricane Irma.² December 2021 wildfires in Colorado resulted in a hospital evacuation in Louisville, CO. My own facility has performed two partial evacuations in the last 6 years, one for an intentional fire set by a patient in our psychiatric hospital and another for an elevator shaft fire in our Women's and Children's hospital following a lightning strike. With SARS-CoV-2 planning and execution fresh in our minds, now is the time to prepare for Hospital Evacuation to ensure if required, your organization gets it "Done Right!"

PRE-DISASTER HOSPITAL SELF-ASSESSMENT: ASSESSING THE RISK AND RISK MITIGATION

All hospitals run the risk of infrastructural failure, fire, chemical spill, and threats due to violence and these threats should be included in any assessment of risk. Regional differences in prevalence of risk exist by the nature of our natural disasters and proximity to large industrial, chemical, or nuclear facilities. Eastern and gulf coast region hospitals are focused on Hurricane and Flood planning, West coast facilities must take into account earthquakes and wildfires, and

the Central region is focused on Tornadoes, storms and flooding. While health care facilities must be prepared for the most likely scenario necessitating hospital evacuation, all scenarios should be considered as all are potential threats throughout the United States.

| Types of Disasters | | | |
|---------------------|---------------------------------|-----------------------|---------------------------|
| Natural Hazards | Infrastructure | Technological Hazards | Terrorism |
| • Floods | • Water | • Hazardous Materials | • Explosion |
| • Tornados | • Steam | • Nuclear Accident | • Biologic Threat |
| • Hurricanes | • Natural Gas | | • Chemical Threat |
| • Lightening strike | • Electricity | | • Nuclear Blast |
| • Winter Storms | • Boiler/Chiller | | • Radiological Dispersion |
| • Extreme Cold | • Security | | |
| • Extreme Heat | • Health Information Technology | | |
| • Volcanos | • Telecommunications | | |
| • Landslide/Debris | | | |
| • Tsunamis | | | |
| • Fire | | | |
| • Wildfire | | | |

A Hazard Vulnerability Analysis (HVA) is recommended by FEMA.³ Analysis takes time and helps identify the potential hazards a facility will face, novel threats and the adverse effects of those hazards and threats will have on both the individual health system and the community. Evacuation planning should consider an all-hazard approach that considers the key factors of the hazard, the relative onset time of the threat, the response time for assistance and resources to mobilize and the staffing required to support the facility in the event of an evacuation. Utilizing a community healthcare disaster preparedness approach, collaboration across different health systems and all essential partners and stakeholders, including local, regional, state, and federal support agencies will ensure all understand the roles and responsibilities of each of community partner in the event of a disaster necessitating hospital evacuation.^{3,4}

Mitigation of risk in some cases may come in the form of structural or physical changes to facilities to reduce risk, (ex: backup generators well above water lines) however these opportunities in most cases are limited. Non-structural risk mitigation is achieved most effectively through two avenues. The establishment of policies and procedures to include memorandums of understanding (MOUs) between organizations prior to any event and the training of staff and preparation exercises to ensure all are well versed in the established tactics, techniques, and procedures to be carried out when hospital evacuation becomes necessary. Many common MOUs are focused on the sharing of transportation expertise, facilities and utilization, and the sharing of supplies, equipment, and personnel.³

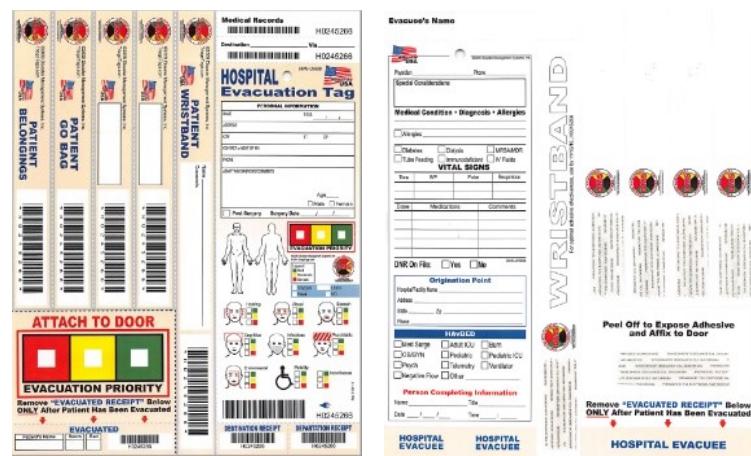
SYSTEM LEVEL PLANNING & PRACTICE

Once a risk assessment and risk mitigation has been completed, system level planning can proceed. One of the most difficult pieces in the planning process is “when?” When do we evacuate our hospital? In most instances a single individual holds the responsibility, and, in many cases, this is an administrator or CEO of a system. Hospital evacuation represents not only a potential high dollar cost in both direct cost of the evacuation and lost revenue but also carries potential high cost in patient health, well-being, and mortality, as the movement of patients is not without risk.⁴ These costs can make this decision difficult. Successful evacuation planning provides the basis for a clear, concise decision process that includes delineation of the trigger points for any evacuation. Trigger points serve as decision points that provide guidance to the authority responsible for the facility. When a threat exists, the plan calls for specific protective actions to be undertaken. Triggers for shelter-in-place versus partial evacuation versus full evacuation must be established. Effective evacuation plans create a concise set of rules governing the evacuation triggers such that the decision to evacuate is clear and definable, thus mitigating many of the external pressures on decision making.⁴

Alternative sites for care, either within an existing health care system or at partner facilities, and the level of care that can be provided at those sites should be determined in the planning phase. Transfer agreements through MOUs are integral to the planning phase for an effective hospital evacuation plan. Resources not only for the evacuation procedure itself but resources for ongoing continuity of care must be considered in planning for care at alternative sites. Patient clinical documentation and data and the physical tracking of patients and patient movement including the personal belongings of patients can be cumbersome in even the most well planned and robust systems. Family or responsible party notification can be arduous especially in a natural disaster event. Tracking of records, equipment and supplies must be accomplished if successful recovery after the event is to occur.

My own system utilizes a band and bar code system for both triage and tracking of patients, materials, belongings, and records. As an internal system without need for cell or internet access, this system allows for tracking in the case of loss of all communications. The form assumes loss of access to EMR with transfer and includes a manual brief medical history and care needs.

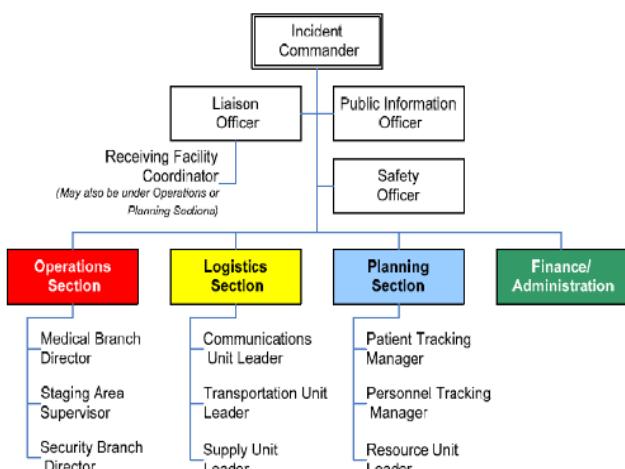
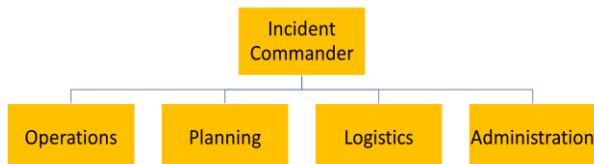
All hospital evacuation plans should encompass scalable gradations of facility evacuation from “shelter-in-place” to horizontal evacuations of a unit, department, or floor to



vertical evacuations of an entire floor to a full-scale hospital evacuation to include operationalization of evacuation staging area and activating transfer agreements or initiated alternative sites of care.

COMMAND STRUCTURE – INCIDENT COMMAND AND COORDINATION

Continued management of healthcare during the COVID-19 pandemic has aligned many leaders in healthcare with the incident command structure for management of other than normal events in our healthcare systems. The Incident Command System was developed following the deadly California wildfires of 1970 in an effort to improve the effectiveness of response through coordination, standardized terminology, command structure and operating procedures.⁵ The hospital incident command system utilizes the principles of the incident command to assist in emergency management planning, response, and recovery for both planned and unplanned events and can integrate with community, state and federal partners as the incident requires. In the planning and training phase for hospital evacuation in response to an event, the incident command structure should be determined, and individual leaders identified and trained to assume the roles when needed. Empowered to make decisions and designed to enable effective incident management through the integration of facilities, equipment, personnel, procedures, and communications within a common organizational structure, it is neither a common format nor does it follow standard daily operating processes in civilian healthcare. At its core, the incident command construct names an incident commander and 4 section chiefs or general staff, to include operations, planning, logistics and administration/finance. Each of the section chiefs then assumes specific areas of responsibility over teams deemed necessary to address the incident at hand. Successful disaster responses require well-defined leadership roles and those in charge ideally would have clinical expertise, excellent leadership and communication skills, an understanding of hospital capabilities and experience in caring for patients when resources are scarce. Some have questioned surgeon's preparedness to lead mass casualty incidents. The American College of Surgeons has stated that surgeons should in fact lead disaster planning and management efforts, especially when involving physical trauma, while others believe that the person with the most relevant experience, regardless of specialty, should assume leadership roles.⁶⁻⁸



Hospital evacuations following disaster or untoward events are no different in the command structure. The ability to instantaneously stand up a health system incident command in a no notice event or a planned standup with an advanced warning event are similar in construct and function though based on the threat to the health system, may or may not require integration with state and federal agencies. Incorporation of additional elements of the health system in the standard construct in the planning phase will better prepare an organization to address hospital evacuations in an organized manner.⁴

In the case of a hospital evacuation, logistics, materials management, transportation coordination and medical asset tracking and management will be key components to a successful evacuation and recovery following the event. Additional concerns not often addressed early enough include management of mass

fatalities as morgue services become saturated and management of post traumatic stress in providers and throughout the community in the recovery phase following any major event. Command structure must take all these elements into account during the planning phases for successful leadership and execution during a hospital evacuation.⁴

COMMUNICATION(S)

Communications are a key element of successful evacuation and can be challenging in the event of loss of services in a major natural disaster and/or during a no notice event. Hospital systems should have in place multiple methods of communication in the event of loss or poor functionality of normal day to day systems. A communications officer should be a part of any robust incident command structure. Internal communications, communication with partnering community agencies/entities for coordination and communication with alternative and/or accepting sites for patient movement are integral to successful evacuation. Regular notification and updates to staff, families, and the community on the status of both the event and the evacuation are critical to maintain community wellness.^{3-5,9}

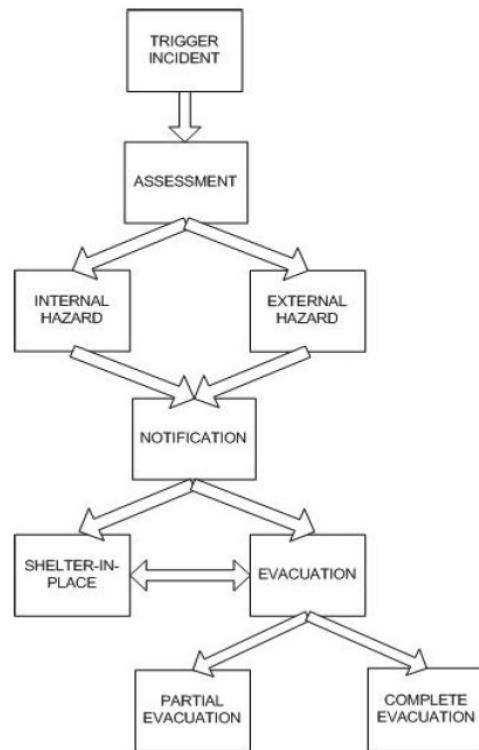
To assist in continuity of care, a core list of minimal information should accompany any patient transferred to another site for care. While this can be accomplished in most cases with a planned evacuation, this becomes very difficult in no-notice or emergency evacuation events. Best practice includes the following information for patient evacuation.

- Unique patient identifiers including family/responsible party contact information
- Medication(s)
- Current medical orders
- Latest lab reports
- DNR or limitation of care/advanced directives
- Restraint Orders
- Receiving Physician Authorization
- Insurance or billing information

DECISION BASED ON THREAT

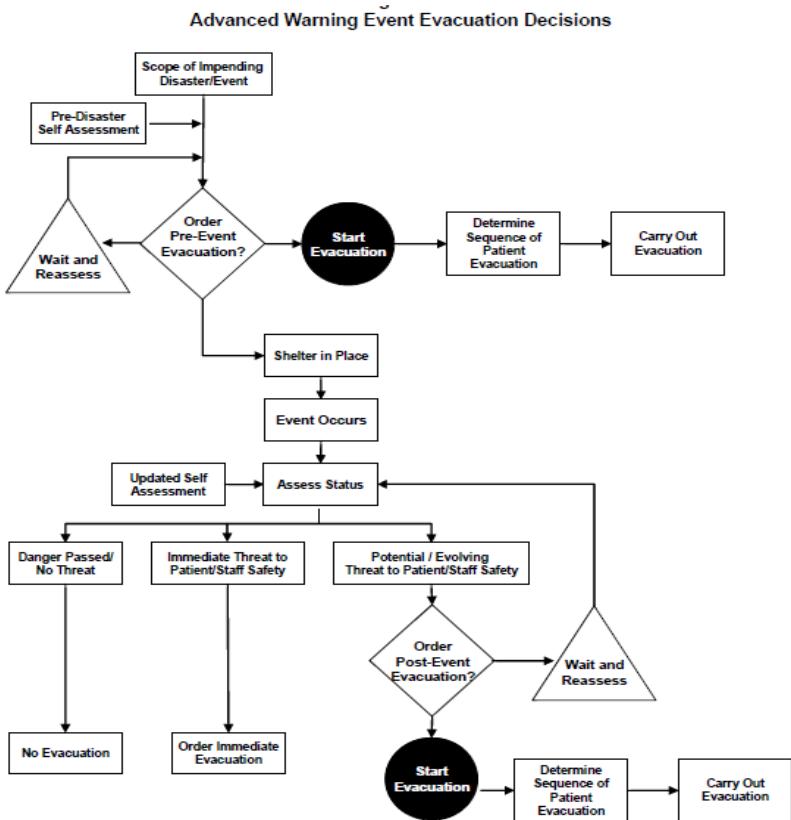
With risk assessed, planning and training complete, and a command structure in place, decision making in the case of a threat to the health system will be driven by the type of threat and the timeline. In many external threats a shelter in place decision with continuous reassessment of the threat or a planned evacuation (complete or partial) can be initiated. Hurricanes, hazardous materials cloud, wildfires in the region, volcanic eruption, storms with rising flood waters that will not damage the hospital but may isolate the hospital due to loss in ingress and egress are examples of external threats. Internal and external threats result in damage to both the hospital and surrounding areas and may be the result of an external threat that progresses. Hurricanes, tornados, floods that damage the hospital or fire/explosions which affect the hospital, and the surrounding area are examples of combined threats. Internal threats in most cases are no notice events which affect the hospital alone and not the surrounding area. Examples include fire, hazardous materials release, or major utility failure within the hospital.

Evacuation Decision Tree



EVACUATING A HOSPITAL

Evacuation of a hospital or health care facility will be driven by the plan that is in place and the timing of the event itself. In the case of an external threat with advanced warning such as an approaching hurricane, evacuation plans can be initiated which will address the most critically ill and labor-intensive patients first and the ambulatory and less labor and equipment intensive patient's last. Some plans may evacuate the critically ill to other facilities while having the ambulatory shelter in place. With time to execute an existing plan with an approaching threat with advanced warning, good documentation, tracking and communication can result in a smooth evacuation and recovery.⁹



| Triage Level | Priority for Evacuation of Patient Care Units REVERSED START PRIORITY | Priority for Transfer to Another Healthcare Facility TRADITIONAL START PRIORITY |
|-------------------------|--|--|
| GREEN - GO | These patients require minimal assistance and can be moved FIRST from the unit. Patients are ambulatory and 1 staff member can safely lead several patients who fall into this category to the staging area. | These patients will be moved LAST as transfers from your facility to another healthcare facility. |
| YELLOW - CAUTION | These patients require some assistance and should be moved SECOND in priority from the inpatient unit. Patients may require wheelchairs or stretchers and 1-2 staff members to transport. | These patients will be moved SECOND in priority as transfers from your facility to another healthcare facility. |
| RED - STOP | These patients require maximum assistance to move. In an evacuation, these patients move LAST from the inpatient unit. These patients may require 2-3 staff members to transport. | These patients require maximum support to sustain life in an evacuation. These patients move FIRST as transfers from your facility to another healthcare facility. |

and tracking are much more difficult and thus can lead to more difficult recovery.⁹

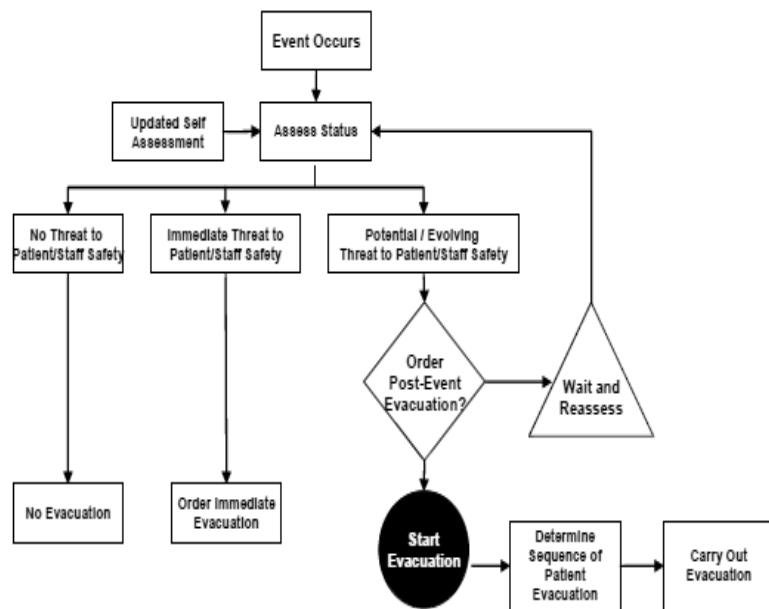
Due to the acuity and timing, a no advanced warning event results in the need for more rapid decision making and continuous reassessment. Plans should be directed to move patients and staff immediately to safety. In most cases this will start with horizontal evacuation, moving a department, floor, or a unit away from the threat to an area of relative safety on the same floor. The loss of electricity in many cases and the inability to utilize elevators makes vertical evacuation more difficult. In the case of a no notice event where safety cannot be achieved through horizontal evacuation, vertical evacuation must be

In the case of a no notice event such as an explosion or fire, execution of an evacuation plan will be more difficult. No notice event priorities change and may require immediate action. The ambulatory are evacuated first in an effort to save the most lives while the critically ill are evacuated last as they are the most labor, staff and equipment intensive. This is counter intuitive and should be practiced with staff through decision training prior to an actual event. In no notice events communications, documentation

undertaken. Without use of elevators, navigation of stairs is challenging and requires significant staff and equipment to perform safely.⁹

As the threat evolves decisions must be made regarding whether to continue to shelter in place vs whole building evacuation, entire campus evacuation or regional/citywide evacuation. Plans and practice for all such contingencies is the only way to ensure success in the event of an evacuation. An integrated community approach utilizing agreements between multiple agencies and systems is the only way to achieve success in a major event.

No Advanced Warning Event Evacuation Decisions



TRACKING AND RECOVERY

Effective recovery following a hospital evacuation will be directly linked to pre-event planning and the ability to communicate and track patients, staff, and equipment. My own system utilizes the bar code system listed above and has scanners/devices at both the points of egress and entry to ensure appropriate tracking. Once the threat has subsided, the hospital must be evaluated for safety and ability to resume care. This can be variable time periods based on the event which necessitated evacuation. In the case of a major tornado or earthquake event, the entire building may not be safe for an extended period and alternative care and staffing plans may be prolonged. Prolonged alternative care will place significant pressure on logistics and materials management. In the event of fire or loss of necessary infrastructure, corrections to loss will take less time and a staged return will likely be possible and some areas of the health system will be brought back online faster than others.

CLOSING

Key to success is planning and flexibility through an empowered and knowledgeable leadership structure which can execute existing MOUs, community agreements and staff training to achieve success in the event of a hospital evacuation.

KEY POINTS

- Hazard Vulnerability Analysis
- Risk mitigation
- Preparation & Planning
- MOUs
- Training
- Triggers for Activation
 - Advanced Warning Events
 - No Notice Events
- Evacuation Types
 - Shelter in Place
 - Horizontal

- Vertical
- Alternative care sites
- Notifications and Communication
- Tracking & Recovery

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EXTRACORPOREAL LIFE SUPPORT (ECMO) RATIONALE FOR RATIONING ECMO ACCESS DURING COVID-19 PANDEMIC

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Extracorporeal Life Support (ECLS), also called Extracorporeal Membrane Oxygenation (ECMO), is a technique for cardiopulmonary support that has been in clinical use since 1972 (both terms are used interchangeably in this chapter). Over the last 4 decades, the tools and devices for the application of ECLS have undergone dramatic improvements, and as our experience has grown the list of potential clinical applications has also expanded. This chapter provides a brief history of ECLS, describes its basic types and their appropriate applications, provides a summary of the clinical trials, and briefly discusses how this life-saving technology should be used during the Covid-19 pandemic.

DEFINITIONS

ECLS is an invasive technique for cardiopulmonary support where blood is drained from the venous system using gravity, and then using a pump passed through an oxygenator, and reinfused into the patient. There are two basic forms of ECLS: venoarterial (VA) where blood is returned into the arterial system, and venovenous (VV) where it is infused back to the venous side. Both of these provide respiratory support (CO₂ and O₂ exchange), but the VA-ECLS also provides hemodynamic support for patients in circulatory failure.

Cannulation: The basic cannulation schemes for the VA and VV ECLS are shown below (**Figure 1**).¹

Over a decade since the initial development of a double lumen jugular venous cannula, percutaneous (Seldinger technique) placement of catheters for VV-ECLS has rapidly gained popularity (**Figure 2**).² At many centers, a single (dual-lumen) large (~31F) cannula placed under fluoroscopic guidance is now the preferred approach for adults requiring VV-ECLS.³ Alternatively, two separate but smaller venous catheters (e.g. femoral for venous drainage and jugular for reinfusion) can be used.

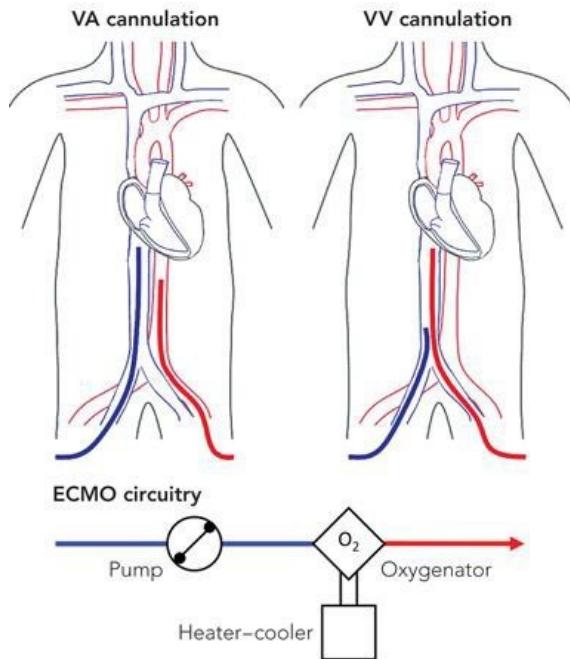


Figure 1: Basic cannulation schemes for venoarterial (VA) and venovenous (VV) ECMO.

Venous blood (blue) is drained and oxygenated blood returned (red) either into the arterial (VA) or the venous (VV) system (VV). There are numerous variations on this scheme. For example, arterial inflow can be through the femoral artery (as shown) or through the carotid artery or directly into the aorta using an open technique. Similarly, venous cannulation site can be femoral (as shown), jugular, or open/transthoracic.

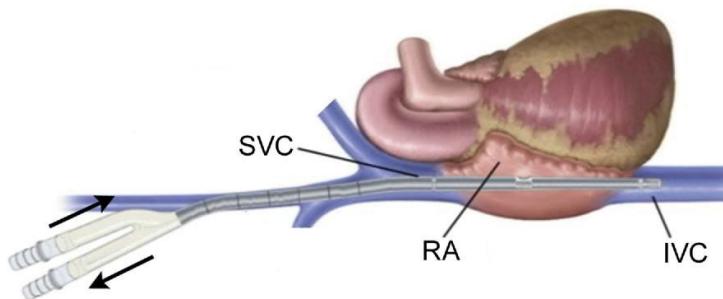


Figure 2: Dual lumen catheter position for VV-ECLS. Arrows show direction of flow. IVC=inferior vena cava; RA= right atrium; SVC= superior vena cava.²

DEVELOPMENT OF ECLS

The father of ECLS, Dr. Robert Bartlett has nicely summarized the fascinating events behind the development of cardiopulmonary bypass by Dr. John Gibbons, and how this circuit was subsequently modified and improved to deliver prolonged support in the intensive care units.⁴ The first reported use of ECLS in 1972 was in a 24 years old poly-trauma patient who had developed severe respiratory failure.⁵ After 75 hours of VA-ECLS this patient recovered normal lung functions and survived. This was soon followed by use of this technology for prolonged cardiac support (36 hrs) in a child with severe cardiogenic shock after the repair of great vessel transposition.⁶ The first multinational randomized clinical trial for treating patients with what is now called Acute Respiratory Distress Syndrome (ARDS) with VA-ECLS showed no benefits, with almost 90% mortality in both groups (ECLS and conventional treatment).⁷ This study has been criticized for its numerous limitations such as the use of VA-ECLS (today VV-ECLS would be considered the standard), very high blood loss (2.5L/day) in the ECLS group, and inclusion of inexperienced centers with no established protocols and no expertise in the new technology. This negative study stopped the development of ECLS for adult ARDS for the next 20 years, but the pediatric community enthusiastically embraced it to treat otherwise lethal respiratory failure in neonates. A few years later, Gattinoni developed the concept of VV-ECLS⁸ and used it successfully in ARDS patients with good results.⁹ While subsequent randomized trials showed excellent results when this technology was used in the neonatal population,¹⁰ similar outcomes could not be replicated in the adult patients.¹¹

MORE RECENT CLINICAL DATA

While good outcomes were reported by dedicated centers,¹² the wider application of the technology was hindered by the complicated and cumbersome ECLS systems. The old circuits were difficult to manage and were potentially hazardous, with a relatively high complication rate. Recently, substantial technological advancements have been made in the circuitry with development of new percutaneous catheters, better pumps and oxygenators, and computer-controlled perfusion systems.

ECLS can now be initiated with bedside placement of percutaneous catheters and the computerized circuits can be easily managed by a well-trained bedside nurse.¹³ These technological advancements coincided with the H1N1 influenza epidemic in 2008-9 that resulted in thousands of cases of severe respiratory failure, often with concomitant septic shock. The use of ECLS in these critically ill patients was associated with an impressive 70% survival rate.¹⁴⁻¹⁷ Around the same time, a multicenter randomized trial was performed in the United Kingdom to compare conventional ventilator support versus extracorporeal membrane oxygenation for severe adult respiratory failure (CESAR).¹⁸ In this trial, 766 patients were screened, 180 were allocated to the two groups (n=90/group), and 75% of the allocated patients eventually received ECLS. The patients that were randomized to the ECLS group (and transferred to the specialized center) demonstrated more than 30% reduction in mortality. In all, 63% of the patients randomized to ECLS (compared to 47% of the control) survived to 6 months without disability. The investigators concluded that delivery of protocol driven care and rapid transfer to ECLS specialized center could be life saving for patients with severe ARDS. The critical care community has learned much from these trials and the role of ECLS in the treatment of ARDS is now much better defined.¹⁹ We now also know that ECLS can be used to safely transport critically ill patients²⁰. For example, at the University of Michigan, 62% of the patients that required ECLS for transport over a 20 years period survived to discharge.²⁰ Not surprisingly, all these recent positive studies have led to a dramatic increase in the use of ECLS, with a 433% increase reported in the US over just a few years (2006-2011).²¹ The rapid adoption of the technology is not limited to the US. The Extracorporeal Life Support Organization database includes > 400 centers internationally that have reported ECLS outcomes in more than 166,000 patients, with an overall survival rate of nearly 55% (**Figure 3**). Review of the database reveals that the outcomes are not uniform. The most frequent use, and the best outcome, continues to be in neonates suffering from ARDS. Whereas, the worst results are seen in adults where the extracorporeal circuit is used for cardiopulmonary resuscitation. Not surprisingly, results at specialized centers are even better than the cumulative data. For example, the University of Michigan has published the largest single center series (2000 patients between 1973-2010), which shows that appropriate use of ECLS can save lives of moribund patients in all age groups.²² when ECLS was used for respiratory failure, survival to hospital discharge was 84% in 799 neonates, 76% in 239 children, and 50% in 353 adults. Survival in patients with cardiac failure was 45% in 361 children and 38% in 119 adults. ECLS was used during cardiopulmonary resuscitation in 129 patients, with 41% surviving to discharge.

Two multi-institutional randomized trials reported their results more recently, which further clarifies the role of ECLS in ARDS patients.

- Extracorporeal Membrane Oxygenation for Severe Acute Respiratory Distress Syndrome (EOLIA) trial²³ evaluated the impact of early ECMO initiation in patients with severe ARDS that were not evolving favorably after 3-6 hours of optimal ventilator management. They were randomized to either receive immediate venovenous ECMO (ECMO group) or continued conventional treatment (control group). Crossover to ECMO was possible for patients in the control group who had refractory hypoxemia. The primary end point was mortality at 60 days. At 60 days, 44 of 124 patients (35%) in the ECMO group and 57 of 125 (46%) in the control group had died (relative risk, 0.76; 95% confidence interval [CI], 0.55 to 1.04; P=0.09). Crossover to ECMO occurred a mean

(\pm SD) of 6.5 \pm 9.7 days after randomization in 35 patients (28%) in the control group, with 20 of these patients (57%) dying. The frequency of complications did not differ significantly between groups, except that there were more bleeding events leading to transfusion in the ECMO group than in the control group. The secondary composite end point of death (in both groups) plus crossover to ECMO (in the control group) showed a benefit in favor of the ECMO group.

- Strategy of UltraProtective Lung Ventilation With Extracorporeal CO₂ Removal for New-Onset Moderate to seVere ARDS (SUPERNOVA) trial²⁴ enrolled patients with moderate ARDS, to test the feasibility and safety of extracorporeal carbon dioxide removal (ECCO₂R) as an adjunct to ultra-protective ventilation (VT 4 mL/kg and PPLAT \leq 25 cmH₂O) in patients with moderate ARDS. A total of 95 patients were enrolled, and the data showed that use of ECCO₂R to facilitate ultra-protective ventilation was indeed feasible.

There is some concern that indiscriminate/improper use of this technology may be harmful for the patients, and also be detrimental to the development of the field. In fact, experts have argued that ECLS is an invasive, complex, and costly modality, and at present its use should be limited to centers with sufficient experience, volume, and expertise to ensure optimal patient outcomes.²⁵

| | Total | Survived to DC or Transfer |
|-----------|---------|----------------------------|
| Total | 166,913 | 54% |
| Neonatal | 46,317 | 64% |
| Pulmonary | 33,934 | 72% |
| Cardiac | 10,025 | 43% |
| ECPR | 2,358 | 42% |
| Pediatric | 32,492 | 53% |
| Pulmonary | 11,638 | 60% |
| Cardiac | 14,865 | 53% |
| ECPR | 5,989 | 41% |
| Adult | 88,104 | 48% |
| Pulmonary | 39,574 | 57% |
| Cardiac | 37,087 | 44% |
| ECPR | 11,443 | 29% |

*N/A - Data elements with n<5 are not displayed.

Figure 3: Extracorporeal Life Support Organization (ELSO) Registry Report.²⁶ ECPR= extracorporeal cardiopulmonary resuscitation; DC=discharge

CLINICAL INDICATIONS

It is beyond the scope of this paper to fully cover in detail the various technical aspects of ECLS, but there are some excellent reviews that provide this information.^{13, 19, 27-30} It should be pointed out that ECLS requires systemic anticoagulation, and contraindications to anticoagulation typically rules out the possibility of using ECLS (despite some case reports of ECLS without systemic anticoagulation). Once ECLS has been initiated for ARDS, mechanical ventilator settings should be adjusted down to minimize barotrauma and to rest the lungs (typically respiratory rates of 4-8/min; tidal volume \sim 100mL; FiO₂ 0.5; PEEP 10-15; peak airway pressure 20-25 cm H₂O).³⁰

An excellent source for detailed information is the Extracorporeal Life Support Organization (ELSO) that has developed and published detailed guidelines covering all possible aspects of this technology, including not only disease specific clinical use but also education and training of providers, and development of centers etc. These guidelines are updated regularly by the experts and can be freely accessed online,³¹ and cover areas such as patient selection, circuit and its components, vascular access, management during

ECLS, weaning, and provides patient and disease specific protocols,³² as well as general guidelines³², and specific recommendations for respiratory³³ and cardiac³⁴ failure.

In the right setting, the use of ECLS today is considered “standard” in cases of respiratory failure, especially in younger patients (with a reversible underlying etiology), when the conventional treatments are failing and expertise for ECLS is available. Institutional expertise is an important consideration, because we know that it takes up to 30 patients to overcome the initial learning curve,³⁵ and that institutional volumes correlate with mortality rates.³⁶ In fact, development of “Regional ECLS Referral Centers” appears to be a more practical and cost-effective strategy than an indiscriminate adoption of the technology across all centers.

USE OF ECLS FOR COVID-19 PATIENTS

As we start 2022, the worldwide covid-19 cases have reached almost 300M with nearly 5.5M deaths. In the US alone, the case count is about to hit 57M with 830,000 deaths. As the Omicron variant surges, the number of cases is likely to increase rapidly. The leading cause of death in these patients is respiratory failure. Not surprisingly, ECLS has been used for the covid-19 patients who have failed other measures. The initial experience in China showed dismal outcomes, most likely because the technology was used as a last ditch effort in moribund patients. Among the 234 ARDS patients in China, 17 (7.2%) underwent ECMO. The mortality rate was 94.1% in the ECMO patients and 70.9% in conventional therapy patients. The pooled odds of mortality in ECMO versus conventional therapy was not significantly different (OR: 2.00, 95%CI: 0.49–8.16).³⁷ As we gained more experience and selected patients more carefully, the outcomes improved. In August 2020, Paris–Sorbonne University Hospital Network, comprising five intensive care units (ICUs) published their retrospective 60 day-outcome data for 83 patients who received ECMO.³⁸ ECMO was considered as a salvage therapy in patient who fulfilled ARDS criteria, and after prone-positioning, neuromuscular blockage, and advanced mechanical ventilation strategies had been tried. Contraindications included: age older than 70 years, severe comorbidities (eg, advanced cardiac, respiratory, or liver failure; metastatic cancer; or hematological malignancies), cardiac arrest, refractory multiorgan failure or Simplified Acute Physiology Score (SAPS) II more than 90, irreversible neurological injury, and mechanical ventilation for more than 10 days. Out of 83 patients, 48 were discharged from the ICU, 5 were still in the ICU and 30 died. Thus, the estimated 60-day survival of Covid-19 patients appeared similar to that of contemporary studies on use of ECMO for severe ARDS for other reasons. However, the same team discovered that the outcomes were very different during the second wave of Covid (after July 2020) where the use of dexamethasone, high flow oxygen, and non-invasive ventilation was more frequent. Respective estimated probabilities of 90-day mortality were 36% and 48% during the first and the second periods, and after adjusting for confounders, mortality was significantly higher for patients treated with ECMO after July 1 (HR 2.27, 95% CI 1.02-5.07).³⁹

The initial US data (68 hospitals) with the use of ECMO in Covid-19 related ARDS was promising. Among the 1297 patients eligible for the target, 45 of the 130 (34.6%) who received ECMO died, and 553 of the 1167 (47.4%) who did not receive ECMO died.⁴⁰ But the generalizability of these findings was questioned as patients were younger (median age of 49), and there was huge variability in medical care prior to the initiation of ECMO. In fact, many of these patients today may not even need ECMO with the proper use of newer treatments such as dexamethasone, remdesivir, and tocilizumab etc. Despite these limitations, these (and many subsequent) studies have established that with proper selection of patients, and with the availability of appropriate expertise and resources, ECMO is a viable option for patients suffering from Covid-19 related ARDS. The real question is not whether we can do it, but should we? This is even more relevant in the setting of limited resources.

In the ELSO registry, 11,693 patients with Covid-19 who required ECMO have been reported (**Figure 4**).⁴¹ In the patients where ECMO was initiated at least 90 days ago (adequate period to monitor mortality),

the in-hospital mortality is 48%. These patients appear to be carefully selected. As a group, they are young (median age 48 years), without major contraindications, and the majority received adjunctive measures (prone positioning, neuromuscular blockage, steroids, remdesivir) prior to ECMO initiation. Compared to the usual ARDS patients, patients with Covid-19 require much longer periods of ECMO support (often months).

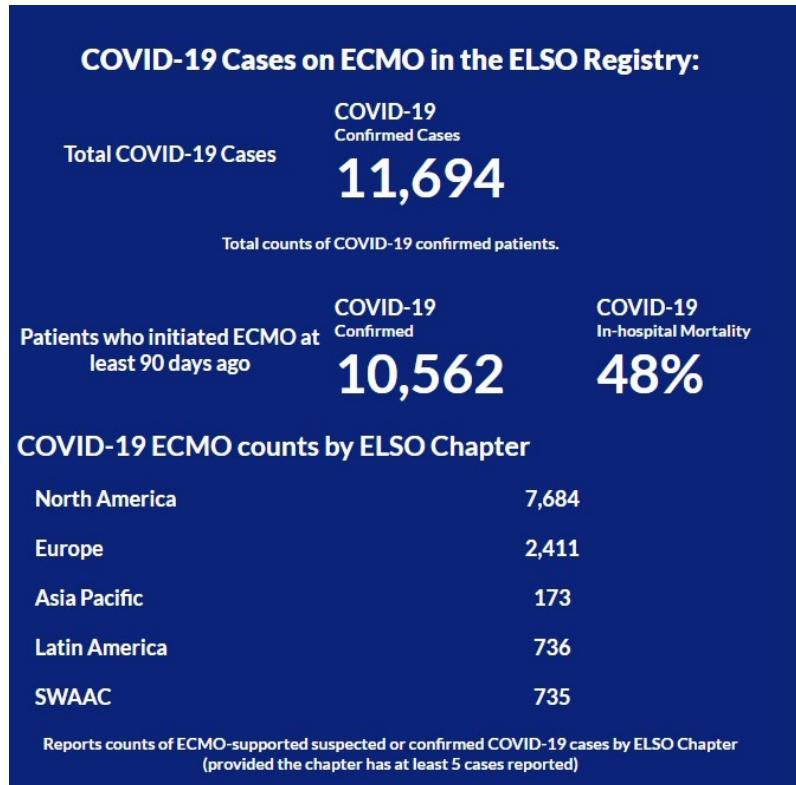


Figure 4: Covid-19 cases in ELSO registry.⁴¹

ELSO Covid-19 working group has developed comprehensive guidelines for the use of the technology in these patients.⁴² While there are no data to suggest deviation from conventional patient selection criteria or ECMO management strategies, when resources become more constrained during a pandemic, more stringent contraindications should be considered. Formation of regional ECMO referral networks is also recommended as it could facilitate communication, resource sharing, expedited patient referral, and mobile ECMO retrieval. While it is important to fairly evaluate the individual patients, it is very important to keep in mind the institutional/regional capacity constraints. ECMO is a finite resource and requires the utilization of other finite resources, such as intensive care unit (ICU) beds and appropriately trained staff. Patient selection must be judicious and equitable, and should become more stringent as capacity diminishes. Involvement of ethics experts during the development and implementation of institutional guidelines should help with these tough decisions. According to these guidelines,⁴² ECMO should be considered as a salvage therapy in carefully selected patients that have failed advanced ventilator strategies, and other adjunctive therapies (**Figure 5**). This approach should be further modified during the pandemic based upon system capacity (**Figure 6**). Thus, even if indications are present, it may not be appropriate to initiate ECMO depending upon the overall condition of the health system.

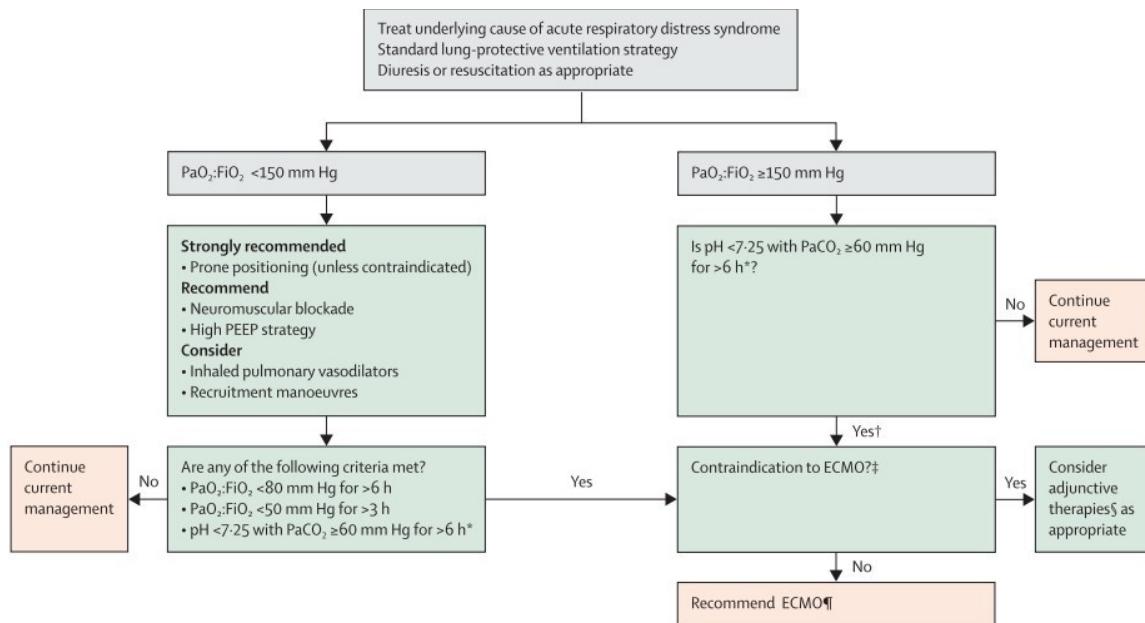


Figure 1. Algorithm for management of acute respiratory distress syndrome, including indications for ECMO. *With respiratory rate increased to 35 breaths per minute and mechanical ventilation settings adjusted to keep a plateau airway pressure of <32 cm H₂O. †Consider neuromuscular blockade. ‡There are no absolute contraindications that are agreed upon except end-stage respiratory failure when lung transplantation will not be considered; exclusion used in the EOLIA trial can be taken as a conservative approach to ECMO contraindications. §For example, neuromuscular blockade, high PEEP strategy, inhaled pulmonary vasodilators, recruitment maneuvers, and high-frequency oscillatory ventilation. ¶Recommend early ECMO as per EOLIA trial criteria; salvage ECMO, which involves deferral of ECMO initiation until further decompensation (as in the crossovers to ECMO in the EOLIA control group), is not supported by the evidence but might be preferable to not initiating ECMO at all in such patients. Credit: Abrams *et al.*³⁹. ECMO, extracorporeal membrane oxygenation; EOLIA, Extracorporeal Membrane Oxygenation to Rescue Lung Injury in Severe Acute Respiratory Distress Syndrome; PaCO₂, partial pressure of carbon dioxide in arterial blood; PaO₂:FiO₂, ratio of partial pressure of oxygen in arterial blood to the fractional concentration of oxygen in inspired air; PEEP, positive end-expiratory pressure.

Figure 5: Algorithm for management of ARDS including indications for ECMO (appears as Figure 1 in Reference #42).

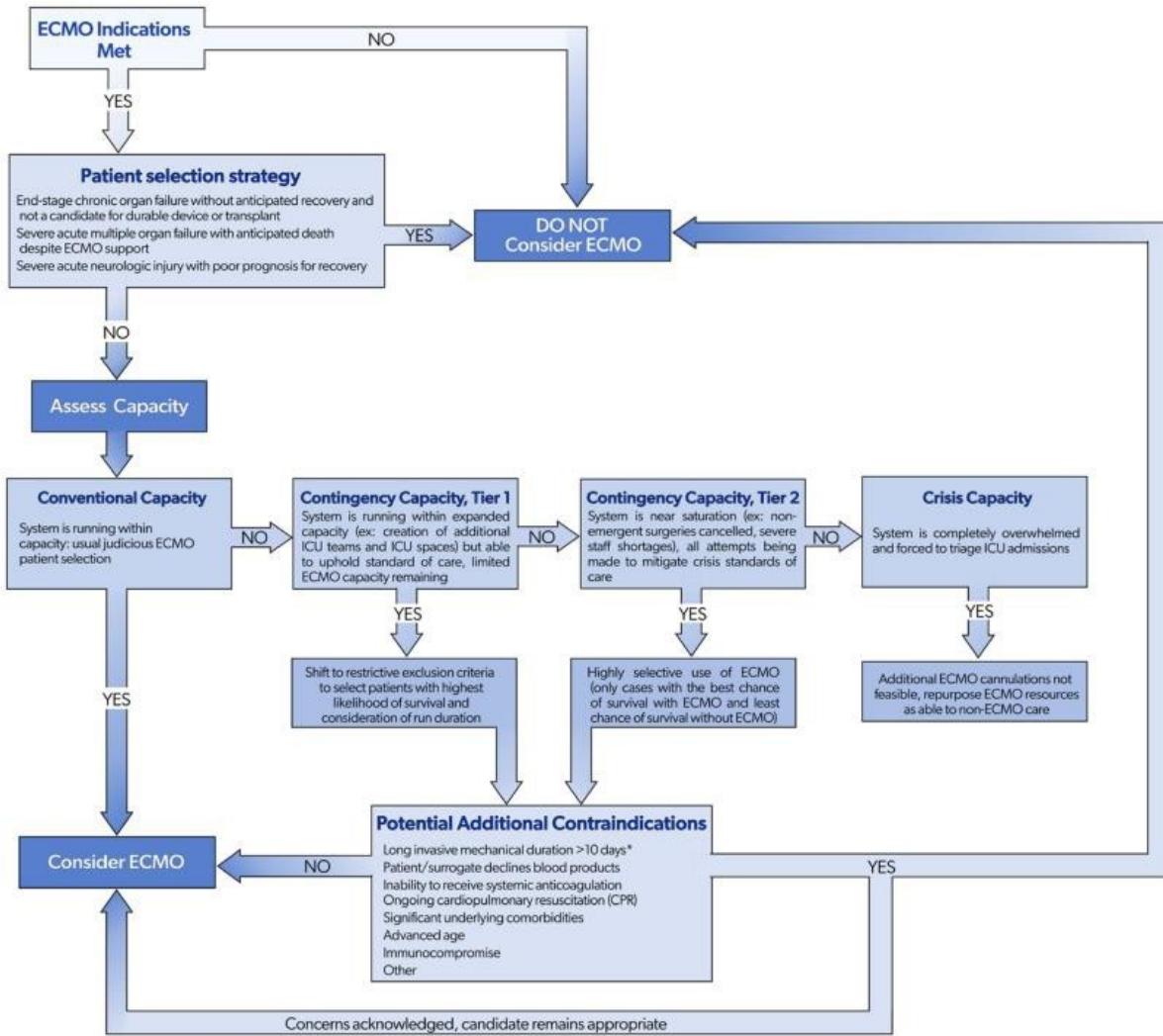


Figure 2. Contraindications algorithm for V-A and V-V ECMO use (COVID-19 and non-COVID-19) during a pandemic based on system capacity. *The impact of duration on high-flow nasal cannula and/or noninvasive mechanical ventilation in addition to invasive mechanical ventilation is unknown. COVID-19, coronavirus disease 2019; CPR, cardiopulmonary resuscitation; ECMO, extracorporeal membrane oxygenation; ICU, intensive care unit; PaCO₂, partial pressure of carbon dioxide in arterial blood; PaO₂:FiO₂, ratio of partial pressure of oxygen in arterial blood to the fractional concentration of oxygen in inspired air; PEEP, positive end-expiratory pressure; V-A, venoarterial; V-V, venovenous.

Figure 6: Algorithm for use of ECMO in pandemic (appears as Figure 2 in Reference #42).

In summary, ECLS is an invasive, complex, but an effective and potentially life-saving tool for providing prolonged cardiopulmonary support in a variety of settings. Recent advances have made it much easier to initiate and maintain, but provider expertise and appropriate patient selection remain crucial for achieving optimal outcomes. Use of ECMO in Covid-19 patients should be considered once the conventional strategies and adjuvant therapies have failed. During a pandemic surge, it is important to not only carefully review all the patient related criteria (indications and contraindication) but also to take into account the logistical limitations of the healthcare system.

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RESILIENCY AND COPING IN FRONTLINE HEALTHCARE PROFESSIONALS

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INTRODUCTION

Resilient is defined as able to withstand or recover quickly from difficult situations or the ability to recoil or spring back into shape after bending, stretching or being compressed.¹ Coping is defined as dealing effectively with something difficult.¹ The stress on the health care systems over the last two years has heightened the awareness of these issues in the work environment. The prevalence of anxiety in healthcare professionals is estimated to be between 20-35% and depression to be 10-20% with frontline providers, such as bedside nurses the most effected.² The events of the past two and half years have placed psychologic burdens on an ever-shrinking workforce. To be able to sustain, organizations need to evaluate the workplace environment and optimize opportunities to build resiliency in the workforce. Unfortunately, key steps and opportunities are often overlooked or not valued until situations strike crisis levels.

DURATION AND PREPARATION

Psychologic stress and the impacts on individuals and communities can be seen in a variety of settings and can impact how individuals prepare and deal with the event. Catastrophic but short duration events such as a mass casualty scenario may prohibit certain types of preparation but are universally understood to be events for which healthcare professionals will need additional assessment and support. Longer, extended events such as the aftermath of a natural disaster require formal organizational support in the form of resources. In both settings, the stressful or traumatic event has an identifiable start and conclusion. This allows individuals to be able to process and mentally package the events so that they can cope with the impact on themselves and their families. The prolonged nature of pandemics can challenge the ability of individuals to process the psychologic impacts as most of the stressors continue and in many ways are increasing. COVID 19 is not the first large scale epidemic and previous experiences with MERS and SARS have given us insight into helpful strategies.

Practical methods to help build resiliency in the healthcare workforce can be seen in recommendations from organizations and mental health professionals from regions who have dealt with similar but regionally contained outbreaks. Education and training, resiliency training, and the perception of preparedness were three key components to provide necessary skills and support to staff to minimize the negative impacts. Education of the virus, mode of transmission, symptoms, risks, personal protective equipment, and practices should be implemented. It is recommended that mental health professionals be brought in to the healthcare providers to educate and train individuals on how to recognize and deal with isolation, fatigue, stress, stigmatization, and feelings of depression.³ Daily support and check-ins with the bedside providers are recommended.⁴ To optimize the perception of preparedness, it is recommended that frontline providers be involved in the development of the action plan that will be

implemented. Providing adequate space, PPE, methods for re-supply, and how to balance workload can all help mitigate concerns and anxiety and help build coping skills.⁵

BUILDING RESILENCY AND COPING DURING CRISIS

Three recommended tactics can be implemented during a crisis to help individuals cope and work to build resiliency. These include communication, providing psychosocial support and treatment and monitoring the health status of the team members.⁵ It is important the information be consistent, available, regularly updated and provided in a manner that will ensure penetration to all relevant parties. Additionally, having a process for the frontline personnel to communicate and have a voice among the decision makers is extremely important to demonstrate commitment to the front team. There must be a way to report incidents, discuss challenges and gain advice for management. A platform for sharing experiences and information with all parties is recommended.⁶ It is recommended that early in the crisis a multidisciplinary psychosocial support team be constructed to ensure adequate resources for frontline workers. Examples such as a 24/7 hotline and facilitated, easy process for referral for more formal, targeted treatment be developed, communicated, and compensated.^{7,8} It is important to allow the frontline work to be able to immediately step away from a particularly stressful situation. Having an immediately available on-site area that can be used to decompress, reflect, or diffuse with a peer or supervisor is critically important. Staff must feel it is acceptable to do this even during very busy periods.³ Monitoring the physical and mental health of the frontline care providers is also critical to aid in identification of those who may need additional resources or strategies before they reach crisis levels. A daily check in/check out with each individual is a low risk, low-cost way to identify the overall state of the person and let them know they are valued and cared for.⁹

There are several important work environment factors that will directly add to or mitigate how frontline care providers cope. Ensuring an adequate provider patient ratio is critical to optimizing care, but also allowing the provider to feel successful in being able to provide the care. Adjusting workshifts and allowing adequate rest time between shifts is important. It is estimated that almost 50% of frontline providers suffer from insomnia and sleep disturbances which will deteriorate their recovery and impact coping skills.² It is recommended to alternate assignments so that heavy workload days are offset by less intense work days as well as limit the front line work to a maximum of 6-8 weeks.^{4,10} Environmental reorganization that provides an immediately accessible area for providers to retreat, rest, and even exercise is important.¹¹ Providing highly nutritional food and drink to all shifts so that providers can focus on patient care while at work and rest while at home is another method that can be employed to optimize the health of the workforce. Building a team identity within the group that focuses on strength and positive messaging has been found to be very beneficial.^{12,13} Additional compensation is also important to help recognize the additional work and burden that the frontline workers are dealing with and can come in a variety of ways. The value to the worker of having childcare, elder care, or pet care not only can be a form of compensation but may help the provider alleviate additional stress or offset feelings of guilt or inadequacy in caring for their family. This type of compensation may be of even greater value to some workers and clearly demonstrates the organization's commitment to the provider.¹⁴

WHERE DO WE GO FROM HERE??

There are several lessons that can be learned and good practices that can be adopted by organizations to aid the frontline care providers in building resilience, but it does require an investment of monetary, programmatic and personnel resources. Best practices as outlined above could help improve workers view of the organizations, improve relations, and help the individual. Unfortunately, many organizations allow themselves to get tied down in bureaucracy and policy and ultimately fail to take action. Helping raise awareness and providing access to training to build resilience will be important to maintain our workforce. Three core traits of resilience include strength, purpose, and pleasure. Helping individuals understand

their own strengths and how they are equipped to handle the environment and stress can help build their confidence in themselves. Keeping a focus on the importance of the work they are doing and providing a sense of connectedness and meaning is critical. Ensuring care providers feel that their efforts are making a difference and are valued directly decreases burnout. Encouraging them to engage in activities that promote enjoyment and supporting them in their down time all help contribute to building resilience.

SUMMARY

Resilience and coping are not innate characteristics that one is born with. They are learned over time and often come because of our experiences. However, they can also be taught. Now, more than ever, the hospital environment needs to recognize the importance of equipping our providers with not only the physical equipment and cognitive knowledge to care for patients, but also teaching skills to form adaptive coping mechanisms and learning steps to build resilience. Without these investments, we will continue to lose members of our workforce as they find more meaningful and fulfilling work.

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CODE ORANGE IN YOUR EMERGENCY DEPT.: PRISONER BUS CRASH

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Multi-casualty or mass casualty incidents are a potential stressor to any health care system. Preparedness is more than just a term used to reduce anxiety and concerns of health care professionals when faced with an influx of more patients than during a typical E.D. shift. Add to the equation when the patients are prisoners and most of us increase our level of concern; the unknown of what type of criminal they are, crime committed, degree of cooperation they will offer all create a potential sense of concern or anxiety for anyone caring for them.

There are several added issues related to caring for incarcerated patients.

- There are guards typically at their bedside so crowd control issues become magnified; depending on the specific reason for incarceration, they may have to remain in very close proximity to the prisoner.
- Different types of restraints are used: hand or leg cuffs/shackles, zip tie style restraints, true chains with keyed locks. Those restraints could limit your access to different areas of the patient's body or make the exam more difficult due to inability to easily reposition the patient. The guards may not allow for removal of restraint systems due to the prisoner's status.
- Perceived or real verbal or physical threats to healthcare team members by prisoners
 - Heightened concerns for personal safety
- Special legal concerns related to a prisoner that are not usual or typical for your 'normal' patient population
 - Consent issues
 - Ethics issues

I am going to begin with a more difficult issue: dealing with prisoners while caring for other usual patients, i.e., real time triage. Personal ethical issues may cloud judgement when dealing with those that may have done harm to others and determining the use of resources during a mass/multicasualty event.

In an editorial from an Israeli group who routinely have to treat both terrorist and their victims, they state:

*"In our opinion, all patients entering the hospital are unequivocally equal without exception. As difficult as it might be, the medical staff must not be judgmental. Punishment is not the role of the medical staff; rather, their duty and obligation is to preserve life and restore health. Judgment should be the exclusive provenance of the legal system and physicians should practice their art without discrimination and with a clear conscience."*¹

The Israelis have had significant experience with this medico-moral dilemma. When an active event occurs or an incarcerated prisoner(s) who performed an act of terrorism or other significant event comes

into an emergency department, we can develop an emotional response rather than an objective medical view of a particular situation. Triage needs to be based on severity of illness/injury with the thought of survival based on available resources and not on other factors that can be labeled as emotional/biased based on non-medical issues related to a person.

So back to our bus incident and the influx of multiple patients that happen to be incarcerated prisoners. Are you prepared for a multi- or mass casualty event? It is my opinion that every hospital should be prepared regardless of location or size; it's not a matter of 'if' but a matter of 'when' you will be involved in such an event.

Does your facility have a police or security presence? Has your facility developed relationships with local law enforcement or local jail/prison personnel? Have you ever dealt with multiple prisoners at one time?

Our bus incident offered many opportunities for our mature Trauma Center to develop some new and also better refine previous guidelines or responses to these events.

- Just like having a triage officer, you need a law enforcement liaison to be able to assist in the rapid evaluation of each prisoner. Whether restraints can be removed or altered to the individual situation, i.e., massively injured may need all restraints removed based on trauma service evaluation and resuscitation requirements.
- Who has a key for the cuffs/restraints or locks on chains and are bolt cutters rapidly available
- How and where to segregate prisoners from the rest of your E.D. patients and contain and control the less injured prisoners awaiting further (delayed) evaluation
- Who is in charge of creating a safer environment relative to removal and storage of sharps: scalpels, hemostats, syringes and needles or anything that could be used as a weapon or means of escape; what should a prisoner NOT have access to?

SECURING THE HOSPITAL/EMERGENCY DEPARTMENT ENVIRONMENT

"Trust, but verify" as stated by President Ronald Reagan has true meaning when it comes to E.D. security processes. You likely were not given a 'primer' or review of procedures and policies for the safety of yourself or team when you joined your present hospital staff. I have good news and bad news: some of the guards you are trusting to manage the prisoners haven't had that training either but your local police typically have had that training.

From a summary printed in CorrectionsOne.com (March 9, 2009) for personnel transporting and guarding prisoners, the takeaway points are worth reading:

- Never leave your prisoner conscious, unrestrained and alone all at the same time
- If they have to be unrestrained, have them outnumbered
- Isolate them from the public as much as humanly possible
- Custody guarantees no privacy
- Surgical and diagnostic procedures may require you to adapt to the clinical environment, but they will never require you to sacrifice every security measure. If you go to the hospital prepared and understanding that it really is the weakest link in prisoner custody, then it's highly unlikely anyone will ever escape from your care and custody

Having an understanding of what the guard's policies and procedures are allow you to work within their boundaries. **Typically, under non-emergency type circumstances, this should not be a problem but during an emergency, mass casualty event, there will be safeguards in place that will be inconvenient and somewhat restrictive to medical personnel BUT they are in place for our protection!!!!** Don't get angry at the guards or law enforcement, they have rules to follow that supersede your 'orders'; work with

them and explain what you need and how you need it done and how quickly. Your sense of STAT will not be the priority level they have!

The American Bar Association has published the Criminal Justice Section Standards Standards on Treatment of Prisoners.²

Standard 23-6.1 General principles governing health care

- (ii) prisoners are provided necessary health care, including preventive, routine, urgent, and emergency care;
- (iii) such care is consistent with community health care standards, including standards relating to privacy except as otherwise specified in these Standards;

Prisoners have the right to informed consent, can refuse treatments but are expected to be treated like any other patient in the E.D. under similar circumstances. Don't let emotions cloud judgement or your professional behavior; if they refuse something or are acting out/yelling/acting violent or uncooperative with you, document in the medical record what happened and if there were witnesses....triage like any other busy day/night. You assessed and tried to provide care and if they agree, fine, if not move on.

BACK TO OUR BUS LOAD OF PRISONERS

Segregate as best you can, keeping prisoners away from the general public. Triage as you have practiced in the past for similar events and categorize all injured patients as your guidelines state.

These prisoners were just involved in a bus crash and had opportunity to acquire potential weapons; glass shards, metal pieces, roadside items, etc.. There were likely not enough guards on scene to prevent some potential weapon from being hidden on one or several of them during the chaos of the event. Do not take for granted that they have all been thoroughly searched by the time they are on a stretcher being evaluated by you. Have a routine that before you interview or exam a prisoner that has not been under a guards constant attention that they are searched. Despite restraints and now a guard at bedside, you could be injured by a hidden weapon so put the odds in your favor whenever possible.

We were fortunate that our bus load of prisoners were not violent criminals but don't depend on knowing that when they arrive. Also, since we are the main facility used by jails and prisons, our staff is used to dealing with them, several at a time and our hospital police, State police, local police as well as other jail guards already in hospital could assist in the E.D...just another day at our trauma center!

Be aware that we remain 'in charge' of their healthcare needs but the guards/police/security personnel have a mission as well and that is to keep us and the public safe and prevent escapes or other problems related to the incarcerated prisoners. Triage as per your usual and spend some time making sure the immediate environment is a safe one for you and the staff. Always have a backup plan, i.e., if you need cuffs/restraints removed for an emergency and a cuff or lock key is not available that bolt cutters are available in your E.D. as soon as prisoners are brought in. Trading hard restraints for soft restraints should be discussed with the guards as should urgent or routine removal or repositioning of all restraints. If problems do arise with your ability to talk to/examine or treat your prisoner patient, document the issues as objectively as possible; do the right things for the right reasons and don't deviate from the standards of care.

The principles of a mass casualty incident are typically the same for the majority of incidents you will encounter. Remaining flexible when you 'get thrown a curve ball' is a necessity we must all acknowledge. Caring for prisoners as our patients just changes the dynamics somewhat; it can be more difficult and frustrating but in order to maintain the quality of trauma care, preparation, table top exercises and pre-

planning with the proper personnel from law enforcement, hospital security and local jails or prisons, etc., can mean the difference of a ‘successful’ vs. chaotic or dangerous mass casualty event.

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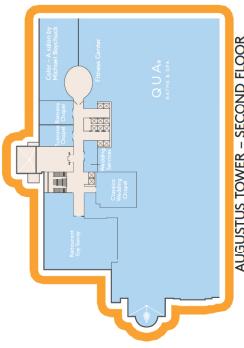
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