THE FUTURE OF MASS FATALITY PREPAREDNESS
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Mass Fatality Events Are on the Rise

Mass fatality events are increasing in frequency. These include natural disasters such as Atlantic hurricanes, whose strength and ability to rapidly intensity has grown in the past 25 years; public health crises such as the opioid epidemic, which contributed to more than 67,300 American deaths in 2018, up from 38,329 in 2010; and mass shootings, which hit a record 417 incidents in the U.S. in 2019. Scientists project that natural catastrophes like severe weather crises and infectious disease outbreaks will only become more common and more dangerous with the advancement of climate change, so the need for implementing proactive measures goes beyond preparing for unpredictable “black swan” events including the current viral pandemic.

No universal number meets the definition of a mass fatality incident, which hinges on the number of deaths that would overwhelm local resources. This threshold varies widely by location. Areas with smaller populations, fewer medical institutions, and tighter budgets may meet the definition quickly, while other municipalities or regions may have higher capacity. Unfortunately, recent events have shown the insufficiency or lack of preparedness efforts worldwide, but particularly in the United States.
In early 2020, the COVID–19 pandemic underscored many medical institutions’ deficits in preparedness for handling surges in deaths. In New York City, that surge looked like a New Yorker dying nearly every two minutes during the peak of the coronavirus outbreak in April, or 800 deaths each day, quadruple the city’s typical volume. The overload meant bodies weren’t easily tracked and weren’t adequately cared for. Hospital morgues, funeral homes, and crematories overflowed, and police found dozens of decomposing bodies inside non–refrigerated trucks parked outside one Brooklyn funeral home after the institution ran out of space inside. Some hospitals ran through their entire supplies of body bags, while others quickly constructed makeshift mobile morgues. Funeral homes began storing bodies in chapels and viewing rooms, relying on air conditioning alone to avoid decomposition for lack of refrigeration. Other New York funeral homes sent away bodies for cremation to facilities as far as Pennsylvania and Vermont. Even a city with a strong disaster response plan for manmade and natural events can become overwhelmed in extreme circumstances. The United States has logged an average of eight mass fatality incidents per year since the year 2000, and New York is considered a high–risk city, but it still wasn’t ready to handle the reality of the pandemic.

Similar scenarios unfolded across the world. In Ecuador, hospital staff stacked deceased patients in bathrooms and families kept their loved ones’ bodies at home for days because the morgues were full. Coffins were placed in common graves in Manaus, Brazil, as more than 130 people died each day, according to the state’s health secretary. Footage at a hospital in Mumbai, India, showed a half–dozen cadavers lying next to COVID–19 patients, revealing how the nation’s health system struggled to handle the outcome of the pandemic. And in America, states like Arizona, California, Florida, Texas, and Washington were overwhelmed by the influx of sick patients and decedents in April, May, and June. The COVID–19 crisis illuminated the gaps in preparedness, proving how surges in death pose operational and logistical challenges for those responding.
Defining Mass Fatality Preparedness

During mass fatality events, institutions such as hospitals, medical examiners’ offices, coroners’ offices, nursing homes, and funeral homes find themselves facing heightened challenges. Personal protective equipment, body bags, storage, and emergency responders can rapidly fall into short supply, jeopardizing the careful handling of cadavers entrusted into the institution’s care. But the challenges for medical institutions extend beyond merely sourcing and acquiring the necessary supplies for processing cadavers.

A LOOK AT MASS FATALITY EVENTS

“Mass fatality events” are relatively undefined in terms of death tolls. Definitions vary from one jurisdiction or agency to another, depending on their available capacities for handling such events on top of their typical daily workloads. Medical examiners’ offices, for example, can easily become overwhelmed by the surge’s effects on the medicolegal death-investigation system and the survivors’ needs for death certificates (which are a prerequisite to obtain other services for the decedent). Similarly, communities’ capacities for handling death surges vary by their locations and preparedness efforts. Therefore, planners should assess their risk tolerance through analyses such as FEMA’s Threat and Hazard Identification and Risk Assessment, or THIRA, which offers a methodology for assessing risk at the national level. The most common and troubling mass fatality events that stress healthcare infrastructure are:

- **Pandemics:** The United States has seen more than 6 million cases of COVID-19 and more than 184,000 deaths as of early September 2020. Globally, there have been over 26 million cases and more than 863,000 deaths as of September 2020. The 1918 influenza epidemic caused 675,000 deaths in the U.S. and 50 million worldwide.

- **Drug epidemics:** In 2018, 67,367 people died from drug overdoses. Almost 70% of them were from opioids.

![Drug Overdose Deaths in the U.S.](image)

Source: National Association of Medical Examiners; Centers for Disease Control and Prevention; New York Times.
• **Terrorism:** The Sept. 11, 2001, attack on the World Trade Center in New York killed **2,753 people in total**.

• **Mass shootings:** In 2019, the U.S. logged **417 mass shootings** and **15,381 total gun deaths**.

• **Wildfires and heat waves:** The 2003 European heat wave killed **over 30,000 people** (possibly **70,000**). In 2010, it’s estimated that a Russian heat wave and subsequent wildfires killed about **56,000 people**. The Camp Fire of California in 2018, the worst fire season in America’s recorded history, left **more than 100 people dead**.

![US Wildfire Acreage Burned](chart)

Source: OFDA/CRED International Disaster Database; Our World in Data.

• **Earthquakes and tsunamis:** In 2004, the Indian Ocean earthquake and tsunami killed **almost 230,000 people**. In 2010, earthquakes killed 226,733 people. It’s estimated that the Haiti earthquake resulted in **about 160,000** of those deaths, although the exact number is uncertain.

• **Landslides:** The **Vargas tragedy** killed between 10,000 and 30,000 people in 1999.

• **Hurricanes:** In the 2005 season, Hurricane Katrina left 1,833 dead, while Hurricane Rita killed 120 and Wilma killed 87.

• **Tornadoes:** In 2011, an F-5 tornado in Joplin, Missouri, killed 158 people.

The larger challenge is thinking through how to use those resources to manage the surge. Mass fatality incidents, by definition, involve more decedents (in number, complexity, or both) than available local resources can handle. Because of that, developing and maintaining relationships — partnerships with county and community agencies; ties to cooperative private sector organizations; and coordination among state, regional, and federal governments — is critical to a successful emergency response plan. Therefore, emergency planners and medical institutions should reframe their plans as a continuous investment into proactive and comprehensive preparedness.

**ON AVERAGE, EVERY FIVE YEARS, SIGNIFICANT NATURAL DISASTERS WILL CAUSE IN EXCESS OF 100,000 DEATHS.**
What the First Wave of the Coronavirus Revealed

The U.S. federal government and most hospital systems were caught off-guard by COVID-19. In late March, FEMA requested 100,000 human remains pouches through an interagency group that put out a nationwide call for more bags. Unfortunately, availability was extremely limited, and that volume of bags that met government specifications couldn’t be produced within a week. The federal government made the request to supplement its stockpile of 50,000 bags, but few companies had excess products waiting on shelves because those small businesses produced quantities to meet consistent orders rather than surges. In reality, it’s taking several months to deliver large orders like these.

When emergency response organizations, hospitals, medical examiner offices, and morgues across the United States began depleting their stocks of body bags, they shifted into emergency mode. Some weren’t sure whom to talk to, and others reached out to companies like Mopec, assuming they had product on hand. Mopec is the largest provider of body bags in the U.S., but it couldn’t deliver the volume of body bags they needed overnight. Mopec now has the capacity to deliver large volumes more quickly than before, but it will still be essential for medical institutions to proactively prepare and communicate with suppliers moving forward in order to avoid emergency shortages.

When New York saw its surge in April, there weren’t enough body bags, and many of the body bags that were available weren’t durable enough to do the job. They tore and leaked fluids that pooled on the floor of mobile morgues. In the U.K., mortuary suppliers ran out of body bags, and healthcare workers ended up wrapping some corpses of coronavirus patients in bed sheets. In some locations, workers doubled or tripled up on thin body bags to ensure durability when regulation bags were unavailable. One first responder in New York fashioned makeshift bags with trash bags and tape in a truck that wasn’t adequately refrigerated to preserve the bodies in the unit.

U.S. PREPARES AGAINST HAZARDS

The U.S. Congress has enacted numerous laws over the years focusing on disaster preparedness. The following laws strive to improve the nation’s public health, medical preparedness, and response capabilities for emergencies, whether deliberate, accidental, or natural:

- **PUBLIC READINESS AND EMERGENCY PREPAREDNESS ACT (PREP ACT)**
- **DEFENSE PRODUCTION ACT (DPA)**
- **PUBLIC HEALTH SECURITY AND BIOTERRORISM PREPAREDNESS AND RESPONSE ACT**
- **PANDEMIC AND ALL-HAZARDS PREPAREDNESS ACT (PAHPA)**

THE U.S. CENTERS FOR DISEASE CONTROL AND PREVENTION OUTLINES THAT BODY BAGS SHOULD BE AT LEAST 6 MILLIMETERS, OR 6,000 MICRONS, THICK TO PROTECT THE BAG FROM PUNCTURES, TEARS, OR WEIGHT-BEARING FAILURES.
Makeshift mobile morgues contained similar inefficiencies. Hospitals in surge areas like New York and New Jersey were procuring refrigerated trucks to help hold bodies when morgues and funeral homes ran out of room. They were storing the bodies on wooden racks, sometimes loading them into the trucks with forklifts, and situating up to 20 bodies in one trailer. The wooden racks also became saturated with fluid and needed to be disposed of after use.

The system they primarily used placed a physical strain on the workers to get the bodies into the trailers and out of the racks because the system was not designed to use mechanical lifts. With a proper tray and rack system, they could have accommodated 84 decedents within the same truck and then stored the unassembled racks for use in future emergencies. Using ineffective supplies put further strain on space.

At the same time, makeshift situations put healthcare and funeral home workers at heightened risk. In addition to taking the standard precautions for all patient care, the U.S. Centers for Disease Control and Prevention says, “If splashing of fluids is expected, additional personal protective equipment (PPE) may be required (such as disposable gown, face shield or goggles and N-95 respirator).” The goal is to minimize contagion.

Though the National Association of Medical Examiners has said the risk of postmortem transmission of COVID-19 through droplets seems to be “minimal,” it’s possible that forensic examiners, who regularly come into contact with cadavers’ biological fluids, may become infected that way, as in the case of a forensic medical professional in Thailand.

That’s why PPE goes beyond N-95 respirators and surgical gowns to include any “equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses,” according to the U.S. Department of Labor’s Occupational Safety and Health Administration. Unfortunately, reports indicated that the U.K.’s stockpile of PPE was expired when the coronavirus hit.
Assessing an Organization’s Preparedness

Devising a mass fatality management plan begins with a clear-eyed assessment of current preparedness. Some institutions in recent months found themselves ill-prepared for surges in deaths, so as the initial COVID-19 rush dies down, they’re asking themselves, “What can we do to avoid this again?” Even if an institution effectively handled the coronavirus pandemic, it should still prepare for unexpected future emergencies. The questions an organization should ask itself partly depends on its location, the area’s population, the community’s proximity to natural hazards (floodplains, earthquake fault lines, etc.), crime rates, and more. Determining risk and capability is nuanced, but these questions should guide an organization’s self-assessment:

**QUESTIONS TO ASSESS LEVEL OF CATASTROPHE PREPAREDNESS:**

- Do we have an emergency preparedness plan in place?
- How many deaths do we routinely see? Do we have the ability to handle a sudden surge of 20 additional bodies while maintaining the integrity of the deceased and the safety of our employees?
- Are we prepared to identify large numbers of remains?
- What resources will we use in the event of an emergency, and how do we acquire them?
- Do we have an emergency stockpile of supplies, including PPE and body bags? Is this stockpile routinely updated to prevent items from expiring?
- Do we know the chain of command when calling for additional supplies?
- Have we been effective at taking advantage of government programs that provide monetary assistance for emergency preparedness? Is our team trained to handle bodies that may be contaminated?
- What is our current cold storage capacity for bodies? Can we increase our cold storage within 24 hours? Are we aware of any organizations that would be able to provide additional cold storage if needed?
- How would we handle communicating with families whose loved ones couldn’t be preserved in cold storage?
- How do we handle our communication to media outlets?
- How has our emergency preparedness strategy fared during previous catastrophes? How is it performing during COVID-19?
- What contingencies have we planned for? Which have we neglected to plan for?
Taiwan SARS Case Study

SARS motivated Taiwan to create a national stockpile of PPE, which they now regularly replenish to ensure no supplies expires before they are needed.

IMPACT OF SARS ON SOUTHEAST ASIA

- SARS coronavirus (SARS-COV), originated in 2002–2003. It affected 26 countries and resulted in more than 8,000 cases and about 800 deaths.
- 80% of all SARS cases were within South Asia. China, Hong Kong, and Taiwan reported the highest numbers of cases.
- The virus disproportionately affected healthcare workers, as PPE shortages put these individuals at a higher risk.
- SARS was eventually contained by the stringent application of infection control measures that limited healthcare workers’ exposure to potentially infectious individuals.

IMPLICATIONS FOR PREPAREDNESS IN TAIWAN

2002: SARS Outbreak Begins:
- The SARS outbreak resulted in a surge in demand for PPE, particularly for medical masks and coveralls. This created a shortage, which put healthcare workers at risk throughout the epidemic.

2003: “A Strategy Plan for PPE Minimum Stockpile” Established:
- A three-tier stockpiling strategy for the central health authority, local health authorities, and medical institutions was created to better respond to future emergency demand for PPE.
- The stockpile includes 3 million N95 respirators, 1.5 million coveralls, and 25 million surgical masks.
- The stockpile was built up through large initial purchases that were stored until use.

2011: Stockpiling Replacement Model Adopted:
- Low usage levels of stockpiled PPE during nonepidemic periods resulted in a portion of the stockpile expiring before it could be used.
- To combat this, the Taiwan CDC adopted a replacement model to keep the stockpile up-to-date.
- Under this model, old stock that is within 2.5 years of expiring is sold to private contractors. It is then replenished with new stock.

BY AUG. 31, 2020, TAIWAN HAD SEEN ONLY 488 TOTAL COVID-19 CASES AND ONLY SEVEN DEATHS IN A COUNTRY OF NEARLY 24 MILLION PEOPLE. THAT AVERAGES OUT TO 0.03 DEATHS PER 100,000 PEOPLE, COMPARED WITH THE UNITED STATES’ RATE OF 55 DEATHS PER 100,000 PEOPLE IN THE SAME TIME FRAME. TAIWAN’S STOCKPILE HAS CONTRIBUTED TO THE COUNTRY’S SUCCESSFUL BATTLE AGAINST THE ONGOING COVID-19 PANDEMIC.
How to Proactively Plan for the Next Crisis

The first wave of the coronavirus pandemic caught most institutions by surprise. Moving forward, it is incumbent on all institutions to proactively determine steps to handle a mass pandemic event and prepare stockpiles in advance of the supply chain dwindling. When faced with surges in fatalities, institutions need solutions they can deploy quickly that work for their circumstances and are safe and practical for their existing personnel. These steps can set in motion proactive preparedness for future mass fatality incidents:

1. **Provide for the physical safety of staff.**
   - Understand staff members’ skill levels and provide training if needed.
   - Plan to alleviate the need for excess lifting, bending, and hoisting that’s manually performed.
   - Ensure that biohazards are minimized (bodily fluids are secured, etc.).

2. **Understand your institution.**
   - Assess how much refrigerated space the building has.
   - Understand the body-moving routes: where they will come from and where they’ll go next (e.g., from the sixth floor of a hospital to a basement morgue).
   - Know which staff members are responsible for transporting the bodies.
   - Decide which equipment staff will need for safely transporting bodies.
   - Project how much storage space you need, both to hold supplies and for cold storage.

3. **Plan to secure emergency funding.**
   - Connect frequently with government officials who are official sources of funding and supplies in order to establish and maintain relationships.
   - Ensure that local governments understand your purpose, support, and supplies.
   - Forecast the budget you would need to handle surges of 20 additional bodies, 50 more, etc.

4. **Design a process for handling decedents.**
   - Determine how the bodies will be transported.
   - Construct or select a refrigerated space where the decedents will be stored.
   - Create and communicate the body-moving plan to workers.
   - Outline how and where the decedents will be placed in appropriate body bags.

5. **Ensure a dignified and safe postmortem process.**
   - Refrigerate all bodies promptly to keep them in optimal postmortem condition.
   - Know the shared practices for locating, identifying, and documenting decedents.
   - Define thresholds for needing to expand in–house morgue capabilities (cold storage, laboratory analysis, etc.)
   - Remember that properly funded disaster response is essential for dignified postmortem processes and offers a necessary service to the community.

6. **Prepare to source quality equipment and supplies.**
   - Calculate the equipment supplies your institution would need to handle surges of 20, 50, or 100 extra bodies.
   - Assess how much storage space can be allotted to emergency supplies.
   - Consider how quickly the organization can rotate stock of supplies that degrade in quality over time.
   - Develop relationships with reliable and consultative suppliers.
   - Gather emergency supplies that fit within the institution’s budget and storage constraints.
   - Ensure that staff members know how to use all supplies.

Medical institutions, just like the crisis situations they may service, are unique, and they require individualized solutions that work for their circumstances. For that reason, the first step to proactive planning is assessing the institution’s specific needs. The choices and logistical concerns that go into designing a plan may be overwhelming and may hinge on finding high–quality equipment and supplies that staff members understand how to use.
Supplies Checklist

These are the quality materials needed to properly handle, manage, and dispose of cadavers during a mass–fatality event. To ensure access to necessary products during this pandemic and other mass fatality events, medical institutions should work with companies who produce PPE in America. The CDC and state emergency management agencies recommend the following supplies:

- **Masks.** Surgical–grade N95 respirators and CAPR respirator systems are among the choices.
- **Medical gowns.** Gowns are graded in four levels of protection; Level 4 is necessary for infectious diseases such as COVID–19.
- **Body bags.** Look for CDC–approved human remains pouches, heat sealers for bags, and alignment clips.
- **Medical gloves and dispensers.** Nonsterile disposable patient examination gloves are appropriate for offering broad barrier protection, according to the Food and Drug Administration.
- **Autopsy tables, carts, and saws.** Tables should allow for workflow efficiency during postmortem dissection.
- **Racks and body trays for remains storage.** Racks should be heavy-duty, suitable for refrigerated environments, easy to roll, lockable, and designed for loading via forklift.
- **Carriers, pallet systems, and cadaver lifts.** These should work together safely and conveniently.
- **Mortuary refrigerators and freezers.** Coolers and refrigerator systems can come either standard or customized; portable human remains cooling systems can eliminate the need for large, stationary units.
- **Cleaners, disinfectants, and neutralizers.** A clean facility is essential for health and safety.
How Mopec Can Help

Mass fatality events are on the rise, and those numbers are likely to steadily increase year over year. Organizations may feel ill-prepared to handle surges in decedents based on their experiences with the novel coronavirus pandemic. That’s why involving Mopec as early as possible in the deployment of quality resources will assist everyone in an appropriate response to the impact that future events will have upon those charged with the task of respectfully and safely handling human remains in mass fatality situations.

The company’s reputation in the industry is the result of its superior customer service specializing in consultation and customization. It has expanded its capabilities to deliver many times the normal industry capacity for body storage equipment, and it now has the capacity to keep up with demand and replenish federal, state, and local stockpiles. Mopec’s position allows it to uniquely offer storage solutions not previously available. For example, the company offers body bags that meet the specifications for the U.S. Department of Defense (NATO) NSN-01-331-6244 Human Remains Pouch, whereas other companies do not. By focusing intensely on its supply chain to increase production capacity, Mopec has secured exclusive production of this bag, along with others, totaling thousands per day. Selecting the right equipment and supplies poses a preparedness challenge, but Mopec is available to help medical institutions prepare for the next disaster.

**COMMON PREPAREDNESS ISSUES AND MOPEC’S SOLUTIONS**

Mopec has expertise derived from decades of experience in safely handling and transporting decedents. Mopec’s experts have helped countless institutions design solutions that meet their needs and their budgets.

**Increasing Steady State Storage Capacity**
- Additional fixed body storage — Refrigeration Units
- Battery-powered hydraulic fork lifts

**Responding to and Preparing for Surge Storage Needs**
- Surge Capacity Body Storage — Mobile Morgue System
- Portable, Flexible Body Storage — MERC System
- Collapsible racks and trays
- Flexible Preparedness Storage Solutions — Guardian Racks

**Providing World-Class Supplies for Healthcare Workers**
- High-quality body bags for COVID-19 response
- Nondurable Body Bags — U.S. Government-Modified BE167-CZ
- Powered Air-Purifying Respirators — MAXAIR CAPR Series
- Advanced PPE — MaxAir CAPRs
  - Alternative to N95s, fortifying the emergency supply chain
  - Can be cleaned and reused in case of emergency
  - Can use multiple filter types, providing better filtration that N95s if necessary
  - Face mask and filter built into one, which reduces the needed supply stock
  - Comfortable to wear with a wide field of vision compared to alternatives
Since it was founded in 1992, Mopec has spent decades building its reputation of superior customer service specializing in consultation and customization. The company commits itself to support customer projects from start to finish, and it is ready to enhance institutions’ abilities to be safe, flexible, productive, and proactive. Below are three case studies that demonstrate Mopec’s ability to meet organizations’ needs and assist with emergency preparedness:

**Case Study #1**
A large West Coast hospital chain wanted to have refrigerated body storage space available at multiple hospitals in case of surges in pandemic deaths. Mopec supplied several dozen refrigerated trailers, properly configured and outfitted with storable racks to maximize storage capacity. Mopec also recommended and produced training videos regarding safe handling techniques to protect hospital personnel from infection and physical injury while handling decedents.

**Case Study #2**
A large healthcare system in New Jersey needed to acquire about 500 body bags quickly in preparation for the imminent death toll from COVID-19. All of the body bag suppliers that the organization contacted were out of stock and could not deliver for weeks. Mopec contracted manufacturing with material companies that did not historically manufacture body bags and that had available capacity due to the pandemic. Mopec was able to start supplying the healthcare system with body bags beginning the following week.

**Case Study #3**
A prominent Northwestern medical examiner’s office was looking for ways to provide additional protection for its personnel, especially in the performance of autopsies. Mopec recommended the use of MaxAir CAPRs, which provide superior protection from viruses and are comfortable to use. Mopec supplied the medical examiner’s office with six CAPR systems to meet its protection needs. Mopec also recommended adding bone dust vacuums to the office’s autopsy saws.

Mopec prides itself on superior customer service that specializes in consulting with customers and customizing solutions that best meet their needs.

For assistance in designing better cadaver management solutions for your organization, please contact Mopec to learn about its total solution to mass fatality response or request a quote.
**Bibliography**


