NATIONAL QUALITY FORUM
Driving measurable health improvements together

Introduction

Below are key questions and elements of attribution models for emergency scenarios. The Committee will discuss these items for each scenario to determine both case-specific and broad attribution considerations and recommendations. Discussant groups will be determined and assigned prior to the upcoming meeting to encourage efficient and robust discussion of each use case. For March 25, we will aim to discuss the first one to three use cases within this document, time allowing. For those questions below, we have identified priority areas in **bold**, but hope to cover any question time allows.

Attribution Elements

Topic	Questions
Goal of the Attribution Methodology and Entities Involved	• What are the desired outcomes and goals? • Which entities provide care? • **What should each entity be accountable for?** • **What quality measures should be used?** • What accountability mechanisms should be deployed? (e.g., what are the levers, rules of participation, value-based or quality reporting programs?)
Defining the Population/ Geographic Regions	• **How should the population be defined?** • What criteria should be used to determine whether an individual should be assigned to a particular population? (Inclusion/exclusion criteria) • **What level of granularity in geography should be utilized?** • Will there be enough cases to cases to draw conclusions about clinician/hospital/EMT performance? • Should all residents in a region or only those that interact with the healthcare system be considered?
Attribution Timing	• **What are the pros and cons of prospective or retrospective attribution options?** • **How should the measurement time frame be defined?**
Data Availability and Capture	• **What data can be used for attribution?** • **To what extent do existing data provide the information needed?** • How should capturing non-healthcare claims-based data points (e.g., auto insurance claims) be approached? Where does the responsibility for collecting this information fall within the care process? • How do we consider accountable units that do not have a health insurance claim (e.g., public health departments, fire departments)?
Patient Role in Care Decisions	• **Are patients able to select where they receive care? If so, how should this be considered as part of the attribution model?**

Team-Based Attribution	• What information or data should be used to determine who/which entity can influence the outcomes of interest? • What are the qualifying events for attribution, and do those qualifying events accurately assign care to the right accountable units? • **If multiple providers have influence over an outcome, should attribution to multiple entities be considered?** • **What weighting approach should be used?** • What input should the accountable units have?
Healthcare System Readiness	• **What structural, communication, and information sharing networks are in place?** • What networks should be developed? • What are some of the federal response protocols that support readiness?
Aspirational Approaches	• **How should high-quality, coordinated care be incentivized?** • What would need to be put in place for these approaches to succeed in encouraging care coordination?
Unintended Consequences	• **What are the potential unintended consequences of attribution decisions?**

Trauma - Draft Use Case 1

Driving back from overnight camping trip a 45-year-old father and his 12-year-old son are involved in head on collision. The driver in other car is pronounced dead on scene. Local EMS evaluated child and found bilateral facial fractures and compromised airway. An LMA was placed, and the patient was stabilized on scene and transferred by air-medical transport to the closest level one trauma center, which is across the state line. Local EMS evaluated the father and found an open tibial fracture, torso abrasions, and left arm laceration. The patient was hemodynamically stable. He was transferred by ground to the local community hospital.

Patient 1 is a 12-year-old child diagnosed with traumatic brain injury and required Oral maxillofacial surgery. He recovers and is transferred back to local community for rehabilitation services and follow up with Plastic and Cosmetic Surgery.

Patient 2 is a 45-year-old male with previous history of Diabetes Mellitus (on Metformin). He is evaluated at the community hospital, where the ED physician performed a FAST, which was negative, and repaired his lacerations. A community orthopedic surgeon performed the repair of his tibia shortly after ED arrival.

The following day father developed peritonitis. A CAT scan revealed mesenteric stranding and intestinal perforation. Patient 2 is transferred to level one trauma center across state lines for repair of intestinal injuries. His tibial fixation repair wound became infected, requiring debridement and skin graft by a second orthopedic surgeon once at the trauma center. The patient ultimately recovered and was transferred to inpatient rehab at facility in his community.

Bombing - Draft Use Case 2

A pipe bomb is detonated in a trash can at a university homecoming event in north central Illinois. The festival is attended by several thousand people, and many are wounded. The area is served by Fire Department EMS, and this city has one Level II Trauma center (X Hospital). The nearest Level I trauma center is 25 minutes by ground (Y Hospital). Specialty services are in state 60 miles east (Illinois), or in out of state 45 minutes north (Wisconsin). Local police and FD are completing patient triage and setting up a casualty collection point (CCP). Fire Department ambulances, as well as mutual aid ambulances are en route to the staging area.

Police officers and on-site EMS are rapidly treating the severely injured, however other assets are instructed to stage until the police determine there are no other immediate explosive threats. Once allowed into the area Fire/EMS assets are directed to collect the victims near each explosion epicenter and take them to the CCP.

Patient 1 is a 47-year-old man in from out of state. He was standing near a trash can that exploded. He has a traumatic amputation to his left lower leg, penetrating injuries to his buttocks and left flank. He also has full thickness burns to his posterior left thigh. In the immediate aftermath, a police officer places a tourniquet on his left lower thigh, then moves on to the other victims.

Patient 1 is collected by a Fire Department ambulance crew and rushed to the local Level II trauma center. He is bleeding in his abdomen and requires an emergent operation. He is transferred to Hospital Y Trauma center later day 1. He has one additional follow up surgery at the Level I before being transferred to the Burn center in Wisconsin. Patient 1 sustains full thickness burns to his left thigh, buttock and left flank requiring grafting and wound care. His abdominal and rectal wounds required surgical repair, and he is discharged with a colostomy.

Upon discharge he is sent to a rehab facility near his home, where he remains for two weeks before being discharged to his home. He receives burn wound care at a local facility and is seen at a tertiary care center closer to his home for further abdominal surgeries, he returns to Hospital Y for his orthopedic surgery follow up and prosthetic.

Patient 2 is a 14-year-old girl who is Patient 1's daughter. She was standing near Patient 1 and knocked down. She is confused and has abrasions and some shrapnel embedded in her face, as well as some bleeding near her right ear. She is awake when collected by a Fire Department ambulance and transported to the Level I trauma center (Hospital Y). Due to her small stature, and LOC she is thought to be a younger child and is immediately brought to a resuscitation bay.

Her CT scan is negative, and her facial wounds appear to be superficial. She has a ruptured eardrum and is admitted to the pediatric floor for observation. She is discharged on day 2 with a follow up appointment with neurology at the Level I Center and instructed to follow up with local ENT.

Patient 3 is an 18-year-old male who suffered a laceration to his left arm. A bystander with "Stop the Bleed" training placed a tourniquet on his left upper arm, and he was assisted by a friend to a car where he is taken to Hospital X. Upon arrival the patient is taken back to a resuscitation bay, but quickly moved to another room to accommodate Patient 2. Patient 3 remains stable initially, but serial assessments by nursing staff reveal hypotension. The patient develops shortness of breath and upon further evaluation the patient is found to have a wound in his left axilla and a developing tension pneumothorax. He is resuscitated, a chest tube is placed to water seal, and his left arm laceration is explored. The tourniquet is released after 90 minutes.

Patient 3 is transferred to Hospital Y by private EMS. During transport, his water seal is closed to air and his tension pneumothorax worsens. The private ambulance crew fails to recognize this, and the patient arrests while the ambulance is two minutes from the hospital. He is resuscitated but has severe deficits due to anoxic brain injury. He spends several days on the ventilator and requires feeding tube and tracheostomy placement. He is discharged to SNF.

Patient 4 is a 67-year-old male with history of Atrial fibrillation on Coumadin. Blunt trauma to right upper quadrant of

abdomen. He was hypotensive at the scene and transported by mutual aid ambulance to Hospital X. On arrival to hospital X, he was intubated and, resuscitated with blood products (2 units of blood and 2 units of FFP), and stabilized by emergency physicians; he then was airlifted to Level 1 trauma center across state lines.

Anticoagulation was held due to trauma and he required exploratory celiotomy and repair of liver. Was unable to start anticoagulation until risk of bleeding resolved after trauma. Patient sustained a cerebral stroke from atrial embolus with permanent hemi-paresis. Recovered to be able to transition to skilled nursing facility for long-term recovery. Follow up with trauma surgeon at the level 1 trauma center and local neurologist and original primary care physician for anticoagulation.

High-Consequence Infectious Diseases – Draft Use Case 3

Key healthcare issues addressed (e.g., "emergency transport"):

- Early identification of potential virus by including recently traveled out of the country questions in triage, physician office and EMS triage and assessment.
- Effective sanitization after EMS transport for patients experiencing specific symptoms and/or that are identified through initial triage
- Adequate resources available to treat patients with HCID's within a given region
- Transportation out of region to other facilities

Population (both approximate quantity and description):

- Rural
- Urban

Severity of injury or illness:

- Quarantined and monitored suspected based contact tracing
- Quarantined and monitored diagnosed and with moderate symptoms
- Critically ill
- Death

Entities involved in response:

- Community physician
- Hospital A Emergency Department at the Critical Access Hospital visit 1
- Hospital A Emergency Department at the Critical Access Hospital visit 2
- Hospital B
- Hospital C
- Ambulance service
- State Health Department
- CDC
- Biocontainment Units within each hospital

Use case:
On March 25, a man aged 45 years (patient 1) went to his doctor in a small, rural town, with fever, initially 100.1°F (38.4°C). He was treated with possible sinusitis and returned home.

The next day the fever increased to 102.9°F (39.4°C), abdominal pain, and headache. He went to the closest ED at a hospital (hospital A, critical access hospital) in a neighboring town. Again, he was treated with possible sinusitis and discharged.

On March 28, the man returned to the same ED by ambulance with persistent fever (101.4°F [38.6°C]), abdominal pain, and new onset diarrhea; During the exam it was identified that the man had recently returned to the United States from Liberia 7 days earlier after attending a conference with his company. Reports out of Liberia state that an Ebola outbreak was just identified. He was placed in a private room under standard, droplet and contact precautions and was tested for Ebola. The test confirmed the patient had the Ebola Virus. Results were sent off to the state health department and the CDC was notified that the patient attended a conference where it is likely the virus was contracted.

CDC teams were called in to establish contact tracing. The patient was transferred via ambulance to a hospital (hospital B) the states designated Ebola Treatment Facility, located in the nearest, major metropolitan city (city A) that had the areas only 10 bed biocontainment unit for isolating and treating patients with high consequence infectious diseases.

The CDC identified other people that attended the same conference with patient 1's company. The company is in city A where the other attendees had returned after the conference. After further investigation conference attendees were contacted and some were found to be experiencing febrile symptoms but had not checked into an ED or visited a PCP.

The attendees were immediately transported to hospital B and admitted to the biocontainment unit. Each patient was tested and found to be positive with the Ebola virus.

Through contact tracing other people in patient's 1 hometown, as well as, in the neighboring town where hospital A is located and in city A were found to be experiencing the same symptoms. With only 10 beds the biocontainment unit was quickly filled. Additional isolation rooms were hastily constructed and filled. Patients were transported to biocontainment centers around the country.

On April 8th patient 1 died. On that same day, a 19-year-old male patient (patient 2) was brought to the ED at hospital C in an ambulance with a temperature of 103.5°F (39.7°C) and abdominal pain. Due to the biocontainment unit and isolation rooms at hospital B being filled the patient was admitted and placed in isolation in hospital C. The next day the patient was transferred to a medical center in a neighboring state that has a biocontainment unit.

Contact tracing did not find a direct connection between patient 2 and patients that were previously diagnosed. Further investigation found patient 2 was transported to the ED for a sports injury five days earlier in an ambulance. The ambulance was found to have transported a patient with a positive Ebola diagnosis that was vomiting blood the same day patient 2 was transported five days earlier. The ambulance had not been thoroughly cleaned in between transports resulting in patient 2 contracting the virus.

Patient 2 was treated at hospital C where he recovered after 21 days and was discharged with continued follow up with a PCP in city A.

Over two-month period forty-eight patients were positively diagnosed with Ebola Virus with a 38% mortality rate. Three hundred contacts were quarantined and monitored for 21 days.

Burn (independent of trauma) – Draft Use Case 4

High-level scenario (e.g., "bombing"):

- Apartment building fire

Key healthcare issues addressed (e.g., "emergency transport"):

- First response – timing, safety, and access to patients
- Difficulty in triaging patient needs for critical care, trauma, and specialty burn care
- Immediate need for rare services including hyperbaric oxygen
- Prolonged needs specialty burn care delivered in dedicated facilities
- Access to pediatric specialty services

Population (both approximate quantity and description):

- Approximately 50-100 patients
- Anticipate 10-20 patients with severe illness
- Anticipate 20-30 pediatric patients, 5 critical

Severity of injury or illness:

- Severe inhalation and airway emergencies requiring emergent intubation
- Severe and moderately ill victims with carbon monoxide and cyanide poisoning
- Severe burn injuries requiring prolonged ICU-level nursing and specialist care in dedicated facilities
- Large number of minor burn injuries in ambulatory patients

Entities involved in response:

- Municipal fire rescue and police
- EMS agencies
- Local hospitals
- Local burn centers and pediatric specialty facilities
- State assistance as needed

Use case:

At 3AM on a winter night, a space heater malfunction leads to a fire in a moderately-sized urban apartment building containing 500 residents. Despite early activation of fire alarms and immediate evacuation of the beginning, approximately 30 apartments are rapidly engulfed in flames. The structural integrity of the building remains intact for a few minutes until local Fire Rescue can access the burning apartment units, but several residents who were trapped in those areas are seriously ill.

Fire Rescue and paramedics attempt to triage victims as they are rescued and initiate transport for the most acutely ill. Twenty victims are found alive but with critical illness. Half are transported to a Level I Trauma Center (Hospital A) located 5 miles away. This facility does not provide burn specialty care but can accept burn patients for initial stabilization and management. Five pediatric victims are transported to a Pediatric Level I Trauma Center, also 5 miles away. The remaining five patients are distributed to two nearby hospitals (Hospitals B and C) without a trauma or burn center designation. A designated burn center hospital (Hospital D) is located approximately 15 miles away in a neighboring city.

An additional 80 patients are estimated to have mild to moderate burn injuries but are ambulatory; several patients

await EMS transport pending transport of critically ill patients, while other patients obtain private transport to various area hospitals. Two additional first responders with Fire Rescue suffered severe burn injuries and were immediately transported to Hospital D.

An emergency shelter is prepared in coordination between local and state officials for all residents of the apartment building, including the unaffected as well as ambulatory patients with minor/moderate injuries but who do not require hospitalization.

Several critically ill patients are intubated upon arrival to the hospital and exhibit signs of severe inhalational injury. A single three-unit hyperbaric oxygen chamber is located at the burn center hospital (Hospital D). Hospitals A, B, and C initiate transfer processes but acceptance is delayed due to difficulty prioritizing patients and coordinating transport given high EMS volume from the scene.

Over the following days, the survivors among the critically ill patients are transferred to Hospital D where they receive prolonged hospitalization for severe facial, hand, and body burns. The hospital care team request assistance from area hospitals and state officials for personnel, equipment, and funding.

In addition, many nearby hospitals refer patients requiring ambulatory burn clinic services to Hospital D. Given the high volume, Hospital D attempts to coordinate with other community clinics, plastic surgeons, and wound care specialists that can provide ongoing care for minor burns, allowing the specialist burn services to focus on high-acuity injuries.

Chemical Attack – Draft Use Case 5

High Level Scenario: At rush hour on a weekday morning in a large metropolitan area, several cannisters placed throughout the subway system release a vapor cloud. Dozens of passengers quickly develop a cholinergic toxidrome with vomiting, respiratory distress, and muscle paralysis. EMS is summoned and begins decontaminating, treating, and transporting several dozen cases. Thousands of less severely ill riders, manifesting either milder symptoms or psychogenic symptoms, egress from the subway without being treated or decontaminated. Some walk to local hospitals and some head home then later goes to the hospital. Overall, 14 hospitals see over 5000 patients as a result of the attack.

Key healthcare issues addressed: emergency response, mass casualty, emergency transport, antidote use, emergency stockpile, attribution

Population: Adult commuters primarily, with a few children, majority of cases working age adults with some geriatric patients

Severity of illness/injury: ranging from death and ICU admission to psychogenic casualties only, with delayed physical and psychological illness

Entities involved in response: EMS, Incident command, hospital ED and ICU, law enforcement, possible military

Use: issues here determining attribution are given that multiple patients with varying degrees of illness may be presenting across multiple hospitals. Additionally, there may be patients who present who were not at the initial site of the incident (such as cab drivers, family members, etc.) who become patients if they are contaminated by residual nerve agent from the original patient so they may present to other hospitals or healthcare providers as a result of the chemical attack even though they were not involved in the initial incident.

Also, will explore:

- Regional preparedness and response – how attribute across multiple accountable agencies responsible for this role as well as across the continuum of care (pre-hospital to hospital and beyond)
- Situational awareness and leadership enacted for event
- Role of EMS, decontamination agencies, initial hospital care, critical care, recovery, and long-term effects of event both medical and psychological
- Are health systems “primed” or “incentivized” financially to bear the burden of the disaster?
- Ems and hospital capacity for disaster with current capacity and allocation challenges

Nuclear – Draft Use Case 6

High-level scenario (e.g., "bombing"): Nuclear power plant reactor meltdown and explosion

Key healthcare issues addressed (e.g., "emergency transport"):

- Acute radiation poisoning as well as likelihood of delayed and chronic illness
- Evacuation of population region surrounding disaster site
- Emergency transport
    - Potential high volume
    - High transportation times
    - Safety of first responders and bystander rescuers
    - Ambulance decontamination
- Safety of healthcare providers
- Capacity of healthcare facilities given scale of incident
- Preparedness for nuclear or radiological emergency

Population (both approximate quantity and description):

- Rural area with limited access to trauma, burn, and tertiary care facilities

Severity of injury or illness:

- Acute
    - Acute radiation poisoning
    - Trauma and burn injuries depending on nature of incident
- Long-term effects of radiation poisoning including cancer and potential unknown illness

Entities involved in response:

- Federal agencies (FEMA, DOE, DOD, NRC, EPA)
- State officials (DOH)
- EMS providers
- Multiple hospitals with differing levels of readiness

Use case:

An earthquake causes an early morning explosion at a nuclear power plant that releases an unknown quantity of radioactive materials into the environment. At the time of the incident, there are 11 employees on site. The facility is located 10 miles from a city of 10,000 residents with an additional estimated 5,000 inhabitants within a 10-mile radius. A larger city of approximately 40,000 residents is 25 miles away. The Federal Nuclear Regulatory Commission (NRC) had, two months prior, found violations at the plant including in the emergency core cooling, although these were not addressed prior to the incident.

In the initial explosion, three workers at the power plant are killed, five critically injured (Patients A-E), and three sustain non-life-threatening injuries but are exposed to large doses of radiation (Patients F-H). Patients A-E sustain primarily blunt trauma injuries due to blast from the explosion, as well as burn injuries. Patients F, G, and H exhibit signs of nausea, vomiting, and headache but are stable in the hour following the incident.

Hospital 1 is a small community hospital located 10.5 miles from the nuclear power plant. Due to planning given their proximity to the plant, Hospital 1 has a large supply of PPE and has previously held preparedness drills oriented to radioactive disasters. Hospital 2 is a Level III trauma center, located 25 miles from the site. Hospital 2 has standard

supply of PPE and has not held preparedness drills. Hospital 3 is a Level 1 trauma center located 60 miles from the site.

Four workers (Patients A, B, F and G) are transported by ambulance (by EMS Agency i) to Hospital 1. Hospital 1 decontaminates the arriving patients and EMS responders. Three workers (Patients C, D, and E) are transported to Hospital 3, where there is a delay in preparing decontamination procedures. Patient H refuses to be transported by ambulance, saying that she wants to save the ambulances for her more seriously injured colleagues.

After initial stabilization, Hospital 1 initiates transfer process for Patients A and B to Hospital 2, given limited capacity to manage severely injured trauma patients at that facility. Hospital 2 declines to accept the transfer due to concern for radioactive exposure, and the patients are transferred to Hospital 3 via EMS Agency ii.

Within six hours of the explosion, the NRC, FEMA, and state officials, in coordination with the National Guard, decide to evacuate all residents within 10 miles of the power plant. Hospital 1 prepares to evacuate. They initiate transfer for 30 currently hospitalized patients to Hospitals 2 and 3, including patients F and G, but encounter limited EMS capacity for this volume of patients given need to decontaminate personnel and equipment with each transport away from the area. Over this time, several new patients begin to arrive at Hospital 2 and other area hospitals with vague symptoms.

Patient H worsens at home and is driven to Hospital 2 by her husband. The patient continues to wear her power plant uniform. She is triaged through the standard mechanism at that hospital and is not decontaminated prior to entry into the emergency department. Her husband develops symptoms of nausea and vomiting after arrival.

Over the coming years, and long after the lengthy process of environmental decontamination and resettlement of the area, the incidence of cancer and autoimmune illness begins to rise in the area. Patients seek specialized care at both local and remote facilities, including Hospital 3.