California Department of Health Services

# Development of Standards & Guidelines for Healthcare Surge During Emergencies

## Scenarios and Use Cases

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# Introduction

Healthcare preparedness and response during a large scale public emergency presents significant challenges for healthcare facilities, licensed healthcare professionals and workers, healthcare benefit payers, government at all levels, and communities. During emergency events, healthcare systems must convert quickly from their current patient capacity to “surge capacity” - a significant increase beyond usual capacity - to rapidly respond to the needs of affected individuals. In a time of significant disaster, a successful plan must predict and provide for the flexible arrangements to address new requirements in both capacity (volumes of patients) and capabilities (types of illnesses) that emerge above baseline requirements. These requirements must be met to save lives, reduce suffering and avoid a human tragedy.

In February 2006, the California Department of Health Services (CDHS) conducted the California Hospital Surge Capacity Survey, a state-wide survey to assess hospital surge capacity among Health Resources and Services Agency participants. The survey identified significant gaps and indicated that many California hospitals lack planning and resources needed to treat patients during emergencies. In order to assist healthcare providers to successfully plan for a healthcare surge, and as part of Governor Schwarzenegger’s surge initiative, the CDHS has launched a project to address the issues of surge capacity during an emergency. The issues that need to be addressed are diverse and include:

- Standards for licensed healthcare professionals and healthcare facilities during an emergency, and liability for facilities and providers;
- Operating plans for healthcare facilities and alternate care sites;
- Reimbursement.

A project team under CDHS direction will convene a broad group of stakeholders and interested parties to develop comprehensive guidelines and standards to enable healthcare facilities, communities, and licensed healthcare professionals to address the many complex issues of healthcare surge capacity planning and response during an emergency. The deliverables under this project fall into two areas:

1. Developing and managing a process that includes government agencies, stakeholders, and other relevant parties as participants in this project;
2. Developing written standards and guidelines for delivery of medical care services in a surge environment.

This document presents the foundational constructs for eliciting and managing stakeholder participation in a process to create concrete deliverables, including templates, regulation changes, and alterations in the reimbursement systems of California to rapidly increase its medical capacity during a public emergency.

# Overview

Surge preparedness is the culmination of three components: operational plans, standards and liability guidelines, and sustainable reimbursement systems. Surge planning can be effective only if all three components are addressed in a holistic manner. A scenario-focused problem-solving approach was chosen as the most effective and efficient means to surface and resolve surge issues as well as provide a visible test for the solutions offered. While many events are simply unpredictable, three scenarios have been selected to illustrate planning for a wide range of patients who have healthcare needs in a public emergency with a healthcare system in "surge mode."

It is important to define the key concepts used in this document. A Scenario is an event that impacts a large enough population to push the healthcare system into a surge mode. Scenario and Incident are used interchangeably in this document. The Patient Profile is a combination of attributes such as age, special needs, and geographic location of a victim from the incident. The Clinical Flow is a patient's experience during a scenario as they move through the healthcare system in surge mode. This patient experience in the aftermath of a scenario event is called a Use Case[1].

Scenarios provide a tangible framework for the development of use cases which were defined as a patient's experience in the aftermath of a scenario. The use cases form the basis for a series of facilitated Collaborative Design Sessions (CDS). A CDS is a facilitated process of intensive group exploration, co-design, and brain-storming to address the strategic and operational needs of communities and organizations. While preliminary issues related to surge preparedness in California have been identified by CDHS, the CDS will enable refinement, augmentation and prioritization of these and newly surfaced issues. The scenarios and use cases will be utilized to highlight the gap between the surge system that exists in California today and a more effective future state. From the gap analysis, specific issues will be identified and prioritized, and stakeholders will drive their resolution in workgroups. An iterative approach will be applied to funnel the issues through the three components of surge preparedness: operational planning, standards and liability guidelines, and reimbursement systems. Resolution of issues will result in the development of planning tools and training materials for surge preparedness in California.

This document is divided into four sections. The first section describes the approach used in selecting three disaster scenarios, creating five patient profiles and describing their clinical flow through a surge environment. Sections two, three and four describe each of the three scenarios and clinical flows of the patients. This document concludes with Next Steps.

[1] The term 'use-case', borrowed from the information technology industry, describes a sequence of actions that occurs during interactions between a user and a system. (Source: Journal of Association of Information System, An Ontological Analysis of Use Case Modelling Grammar, Irwin & Turk)

# Section I: Surge Planning Scenarios and Use Case Development Process

## Development of use cases considered three key components:

Figure 1. Use Case Development Approach

- Scenario Definition: Identifying hypothesized events that would result in a catastrophic disaster and would test the surge management system;
- Patient Profile Selection: Selecting a representative sample of patient types that would use the surge management system;
- Clinical Flow Development: Healthcare experience of selected patient profiles through the surge management system following an incident.

## #1: Scenario Definition

Figure 2. Scenario Definition

The scenario choice was accomplished in four steps. These steps are: 1) Defining the consideration set; 2) Defining the consequential attributes[2]; 3) Filtering the scenarios; and 4) Choosing the final scenarios.

[2] Refer to Page 8, Step Two for description.

## Step 1: Defining Consideration Set

Extensive research was conducted to identify a base set of scenarios. "National Planning Scenarios", a document developed by the Federal Interagency (coordinated by the Homeland Security Council in partnership with the Department of Homeland Security), was identified as a primary source. The Federal Interagency has developed fifteen all-hazards planning scenarios for use in National, Federal, State, and Local homeland security preparedness activities. The fifteen scenarios are listed in the table below:

| # | Scenario |
|---|---|
| 1 | Nuclear Detonation – 10-Kiloton Improvised Nuclear Device |
| 2 | Biological Attack – Aerosol Anthrax |
| 3 | Biological Disease Outbreak – Pandemic Influenza |
| 4 | Biological Attack – Plague |
| 5 | Chemical Attack – Blister Agent |
| 6 | Chemical Attack – Toxic Industrial Chemicals |
| 7 | Chemical Attack – Nerve Agent |
| 8 | Chemical Attack – Chlorine Tank Explosion |
| 9 | Natural Disaster – Major Earthquake |
| 10 | Natural Disaster – Major Hurricane |
| 11 | Radiological Attack – Radiological Dispersal Devices |
| 12 | Explosives Attack – Bombing Using Improvised Explosive Devices |
| 13 | Biological Attack – Food Contamination |
| 14 | Biological Attack – Foreign Animal Disease (Foot and Mouth Disease) |
| 15 | Cyber Attack |

Table 1 - National Planning Scenarios developed by The Federal Interagency of the Homeland Security Council

From the group of fifteen scenarios, "Cyber Attack" was removed from consideration because it did not have a impact on healthcare (However, the substantial impact on communications and computer-based systems was acknowledged.) The remaining scenarios were then modified to reflect scenarios relevant to California such as Heat Wave, Wild/Urban Fires, and Electrical Power failures. Due to similarities in consequences from water-related disasters, "Major Hurricane", was expanded to "Major Hurricane/ Tsunami/ Flood".

The seventeen scenarios, listed on the following page, formed the consideration set from which surge planning scenarios were identified.

| # | Scenario |
|---|---|
| 1 | Nuclear Detonation – 10-Kiloton Improvised Nuclear Device |
| 2 | Biological Attack – Aerosol Anthrax |
| 3 | Biological Disease Outbreak – Pandemic Influenza |
| 4 | Biological Attack – Plague |
| 5 | Chemical Attack – Blister Agent |
| 6 | Chemical Attack – Toxic Industrial Chemicals |
| 7 | Chemical Attack – Nerve Agent |
| 8 | Chemical Attack – Chlorine Tank Explosion |
| 9 | Natural Disaster – Major Earthquake |
| 10 | Natural Disaster – Major Hurricane/ Tsunami/ Flood |
| 11 | Radiological Attack – Radiological Dispersal Devices |
| 12 | Explosives Attack – Bombing Using Improvised Explosive Devices |
| 13 | Biological Attack – Food Contamination |
| 14 | Biological Attack – Foreign Animal Disease (Foot and Mouth Disease) |
| 15 | Natural Disaster – Heat Wave |
| 16 | Natural/ Man-Made Disaster - Wild/ Urban Fires |
| 17 | Electrical Power Failures |

Table 2 - Scenario Consideration Set

## Step 2: Defining Consequential Attributes

To reach a manageable set of scenarios, while retaining the inherent healthcare challenges of each one, the seventeen scenarios were evaluated against twelve consequential attributes. Each scenario's consequential attributes describes the impact of an incident on the population. The consequential attributes and their associated impact ratings are represented in the table on the next page.

| | Scenario's Consequential Attributes | Attribute Impact Ratings |
|---|---|---|
| 1 | Type: | a. Long Term Catastrophic (10,000+ casualties)<br>b. Short Term Catastrophic (10,000+casualties)<br>c. Moderate (250 to10,000 casualties) |
| 2 | Scope: | a. Local<br>b. Regional<br>c. State-wide/ National/ Global |
| 3 | Impact on Healthcare Facility: | a. Widespread/ Most Issues/ Long Term<br>b. Moderate<br>c. Minimal Impact/ Short Term<br>d. No Impact |
| 4 | Impact on Healthcare Medical Personnel: | a. Widespread/ Most Issues/ Long Term<br>b. Moderate<br>c. Minimal Impact/ Short Term<br>d. No Impact |
| 5 | Impact on Healthcare Supply Chain Impact: | a. Widespread/ Most Issues/ Long Term<br>b. Moderate<br>c. Minimal Impact/ Short Term<br>d. No Impact |
| 6 | Injury Type:<br>(based on HRSA's surge requirements[3]) | a. Infectious Disease (propagating)<br>b. Infectious Disease (non-propagating)<br>c. Radiation Induced Illness<br>d. Trauma/ Burn<br>e. Chemical Poisoning and Botulinum |
| 7 | Population Displacement: | a. Widespread/ Most Issues/ Long Term<br>b. Moderate<br>c. Minimal Impact/ Short Term<br>d. No Impact |
| 8 | Lead Time: (prior to incident) | a. Short<br>b. Medium<br>c. High |
| 9 | Recovery Time: | a. Days<br>b. Weeks<br>c. Months<br>d. Years |
| 10 | Probability of Occurrence: | a. Low<br>b. Medium<br>c. High |
| 11 | Ability to Generate Casualties: | a. Low<br>b. Medium<br>c. High |
| 12 | Ability to Generate "Worried Well" (Potentially exposed/Injured): | a. Low<br>b. Medium<br>c. High |

Table 3 - Consequential Attributes and Impact Ratings

[3] HRSA surge requirements specifically address four classes of patients: 1) acute infectious disease, 2) chemical poisoning and botulinum, 3) trauma and burn, and 4) radiation-induced illness. Infectious disease was split into propagating and non-propagating to accurately associate them with the relevant scenarios.

## Step 3: Filtering the Scenarios

The seventeen scenarios were cross-referenced with the consequential attributes. Appendix A highlights this methodology and the resulting scenarios are listed below.

The results demonstrated the varying degrees and complexity of stress on the healthcare system. For example, a Radiological Dispersal would be a Long Term Catastrophic incident, generating trauma/ burn and radiation induced victims, recovery time in years, and a moderate impact on the healthcare system. However, a Pandemic Influenza would have both a Short Term Catastrophic and a Long Term Catastrophic incident, generating an immediate and on-going impact on the healthcare system, with significant casualties in minimal time as well as severe long-term impact on the healthcare system.

1. 10-Kiloton (KT) Improvised Nuclear Device
2. Radiological Dispersal Devices
3. Earthquake
4. Major Hurricane/ Tsunami/ Flood
5. Wild/ Urban Fires
6. Pandemic Influenza

## Step 4: Choosing the Final Scenarios

A review of the six filtered scenarios and their consequential attributes and ratings resulted in natural groupings that were further refined to adapt to California's environment. The result of groupings and refinement was the creation of three final scenarios listed as follows

1. An earthquake with resulting fires and floods (composite of Earthquake, Major Hurricane / Tsunami / Flood, Wild / Urban fires);
2. A nuclear explosion resulting in radiation dispersal (composite of 10-K Improvised Nuclear Device and Radiological Dispersal Devices);
3. Pandemic Influenza.

The location of each incident was chosen to address the breadth of California's geography. The earthquake strikes San Francisco with after effects in Sacramento and surrounding rural areas; the nuclear explosion occurs in Los Angeles; and the pandemic influenza occurs at multiple communities across California. The consequences and impacts of each scenario were designed to represent a significant demand on resources and the healthcare delivery system. In addition to individual patient experiences, public health and healthcare infrastructure impacts were included in each scenario to provide a realistic setting that planners must overcome while designing appropriate surge management.

Recognized contributors to the field of surge planning from California Department of Health Services, California Emergency Medical Services Authority, University of California - Irvine, Texas A&M - Health Science Center, Institute of Medicine, and Agency for Healthcare Research and Quality reviewed the scenarios for technical accuracy. The feedback received has been supplemented with review of publications by leading national organizations such as Federation of American Scientists and Centers for Disease Control and Prevention.

# #2: Patient Profile Selection

Figure 3. Patient Profile Selection

Patient profile selection required identifying key patient attributes and using attribute variables to create the profiles. The profiles place the incident victims in various locations (rural, urban, etc.) to surface relevant surge management issues

## Step 1: Patient Attributes

Key patient attributes, reflective of California's population, were identified in order to select the patient profiles (See Appendix B). Important demographic characteristics of the population that influence healthcare services were taken into consideration. Researched literature and prior disaster events led to certain attributes that were found to have a significant impact on surge management following large scale disaster.

Experiences from Hurricane Katrina were reviewed in relation to California population characteristics in order to create comparable patient attributes that would stress the system further. Attributes such as Age, Health Status, Financing, Language, Special Needs, Legal Status, Geographic Location (Rural/Urban), Socio-Economic Status, and Religious Affiliation, were of primary interest (See Appendix B). Variables were then attached to each attribute. For example, the attribute Age includes Child, Teen, Adult, Middle Age, Senior and Frail Elderly. Each attribute was assigned anywhere from three to eight variables.

The table on the next page presents the patient attributes and the attribute variables.

| Patient Attributes | Attribute Variables | |
|---|---|---|
| Age | • Child<br>• Teen<br>• Adult<br>• Middle Age<br>• Senior<br>• Frail Elderly | |
| Health Status | • Well<br>• Pregnant<br>• Chronic Illness<br>• Disabled<br>• Acute Care (Time of Disaster) | |
| Gender | • Male<br>• Female<br>• Trans-gender | |
| Marital / Family Status[4] | • Married (Spouse Present)<br>• Married (Spouse Absent)<br>• Widowed<br>• Divorced | • Separated<br>• Never Married<br>• Domestic Partnership |
| Financing[5] | • Employer<br>• Medi-Cal (State)<br>• Medicare (Federal)<br>• Self-Pay<br>• None | |
| Language | • English<br>• Non-English (Spanish, Asian, Other) | |
| Special Needs | • Disabled<br>• Hospice<br>• Behavioral Health Institution<br>• Patients in Hospital | • Nursing Home<br>• Home Health Care<br>• None |
| Legal Status | • Legal Resident (U.S. Citizen, Permanent Resident)<br>• Undocumented<br>• Temporary (Visa )/ Tourist) | |
| Geographic | • Rural<br>• Urban<br>• Suburban<br>• Tribal | |
| Socio-Economic Status | • Low Income<br>• Middle Income<br>• High Income | |
| Race | • African-American<br>• Asian<br>• Caucasian | • Hispanic<br>• Native American<br>• American Indian |
| Religious Affiliation | • Atheist<br>• Buddhist<br>• Catholic<br>• Hindu | • Jewish<br>• Muslim<br>• Protestant<br>• Other |

Table 4 - Patient Attributes and Variables

[4] All relevant attribute variables "With or Without Children"
[5] Source of Healthcare coverage

## Step 2: Patient Profiles

Five patient profiles were identified for the development of uses cases, to test the healthcare system during a scenario in the broadest way while avoiding redundancies. The profiles generate mild to severe stressors on the healthcare system and thus surface a diverse set of patient care issues. The selected patient profiles represent a wide cross-section of the population, and elicit discussion regarding issues that arise as a result of a patient interacting with the healthcare delivery system. The attributes are designed to highlight the issues that create the gap between what exists today and a more effective surge system. They are not meant to reflect or support any cultural, gender, or age-specific stereotypes. Appendix B summarizes data relevant to population attributes in California.

The table below presents the five patient profiles with their attribute variables prior to the incident. .

| Profile | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Name | MG | RK | AA | EB | JP |
| Age | Adult | Child | Teen | Middle Age (55 years) | Frail Elderly (85 years) |
| Health Status | Well | Asthmatic | 30 weeks Pregnant/ Gestational Diabetic/ HIV+ | Coronary Heart Disease, Renal Failure, Diabetes and Dialysis | Alzheimer's (Nursing Home/ Home Care) |
| Gender | Female | Male | Female | Male | Female |
| Marital Status | Married | Single | Single | Divorced | Single |
| Financing | Insured | No Insurance | Medi-Cal | Insured (Military Retiree) | Medicare |
| Language | Spanish | Indonesian (arrived 2 months ago) | English | English | English |
| Special Needs | Dog owner | Language Barrier | 30 weeks Pregnant | Leg Amputee | Vision/ Hearing Impaired |
| Legal Status | US Resident | Undocumented | US Citizen | US Citizen visiting from Miami | US Citizen |
| Geographic | Urban | Urban | Juvenile Detention Center | Urban | Rural |
| Socio-Econ. Status | Middle Income | Low Income | Low Income | Middle Income | High Income (US Senator's mom - high visibility patient) |
| Race | Hispanic | Asian | Native American | African American | Caucasian |
| Religious Affiliation | Catholic | Muslim | Native American Spirituality | Unique Religious Needs (Blood, medicines) | Protestant |

Table 5 - Patient Profiles and Attributes

## #3: Clinical Flow Development

Figure 4. Clinical Flow Development

The clinical flow or the patient's experience through a surge management system in the aftermath of a scenario is called a use case. The use case is the user's view (patient's view) of a sequence of events and encompasses a problem and the system's response to address the problem. The use case diagrams depict the steps a patient takes as s/he encounters the healthcare system in surge. The five patient profiles were passed through each of the three scenarios resulting in fifteen use cases.

## Key Assumption - Surge Management System with Minimal Barriers

The key assumption driving the use cases is that a surge management system with minimal barriers exists in California. Each use case, regardless of the clinical outcome, describes a barrier-free patient experience through this system. These use cases occur at a point in time within the scenarios, when maximum stress would be placed on the healthcare system.

The expected outcomes from the Collaborative Design Sessions are the identification, validation and prioritization of issues (gaps) between the current and a barrier-free surge management system in California. For example, the efficient evacuation of patients from damaged hospitals in an earthquake scenario assumes that evacuation plans exist and have been tested with trained staff. Navigating through the use cases in the Collaborative Design Sessions will surface issues related to current preparedness which may include insufficient protocols, changing priorities, and lack of staff training.

Below is a hypothetical description of a surge management system with minimal barriers in California:

Emergency response in California will be carried out under the authorities of the Emergency Services Act (ESA) and the California State Emergency Plan (SEP). Government agencies responding to disasters in California will adhere to the Standardized Emergency Management System (SEMS). The organization and policies under which public agencies will meet their emergency management responsibilities and coordinate their response are defined by SEMS, the California Disaster and Civil Defense Master Mutual Aid Agreement (MMAA), and the National Incident Management System (NIMS) and National Response Plan (NRP).[A]

Multiple partners at the Federal, State, and Local levels have been collaborating and planning for the next catastrophic incident. The partners include, but are not limited to: the medical community, law enforcement, emergency management, and public health agencies. They have established mechanisms for integrating disaster preparedness and response planning, and developed policy and strategy options for disaster response at the state and local level. During emergency situations, emphasis would be placed on saving lives, controlling the situation, and minimizing the effects of the disaster. Immediate medical response actions are accomplished within the affected area by government agencies (including requests for mutual aid) and private medical care responders. During this phase, Incident Command Posts and Emergency Operation Centers (EOCs) are activated, and emergency instructions are issued to the public.

The hospital disaster management plans are based on the Hospital Incident Command System (HICS). The majority of hospitals have protocols for hospital lockdown, cancelling elective surgeries, early patient discharge, surge unit and ICU beds with supplies and equipment, surge staffing, day care for children of staff, designating victim overflow areas, commercial supplier arrangements, and pre-disaster "preferred" vendor agreements, including Vendor-Managed Inventory (VMI). All have emergency medical services compatible radios and more than three days worth of supplies. Most hospitals have mutual aid agreements with other hospitals or long-term care facilities. A vast majority of hospitals have conducted multi-agency drills. In place are arrangements for alternate care sites (ACS) that are scenario dependent, staffed by professional and non-professional human resources, and supported by robust, agile supply chain support and management. In addition, adequate funding flow to institutions and the supply chain is maintained.[B]

Some of the key issues addressed as part of the State's surge preparedness include:

- Legal and other barriers for healthcare facilities and affording flexibility during an emergency and surge environment;
- Protections to individual licensed healthcare professionals. This would include use of volunteers, medical reserve corps, use of expanded scopes of practice, and use of other healthcare professionals licensed in or outside of California but without hospital credentialing or privileges;
- Reimbursement requirements including the Medicare Conditions of Participation, state licensure, healthcare plan and provider requirements, and standard payer agreements;
- Standards and protocols for rapidly establishing and operating alternate care sites in medical and non-medical facilities.

Communication planning and interoperability has ensured that the public, media, and healthcare professionals will receive accurate information, with frequent updates throughout the emergency. The potential for confusion will be minimized through the identification of a primary spokesperson to disseminate accurate information (i.e., Joint Information Center).[C]

## Scenario and Use Case Outline

Each scenario and use case follows the same general outline.

### Scenario

- Hypothetical description of California's surge preparedness specific to the scenario
- Scenario description
- Estimated consequences
- For each of the five use cases that follow:
  - General overview
  - Acronyms and Legend for the Clinical Flow.

### Taxonomy

- In order to aid the planning process, a taxonomy has been developed to map issues to the scenarios and use cases. The following taxonomy was developed to reference each use case in a systematic and standard manner. As an example, use case for Nuclear Explosion, MG, Process Step #1 has been outlined below (NE.MG.1):
  - Scenario: Nuclear Explosion = NE
  - Patient Name: MG
  - Process Step: 1 = 1

# Section II: Scenario - Earthquake with Resulting Floods and Fires

## California's Healthcare Surge Preparedness for an Earthquake

State and Federal disaster field offices have developed plans to coordinate response efforts using SEMS and mutual aid agreements. If an incident were to occur, the American Red Cross (ARC) would mobilize thousands of volunteers and would coordinate with the State on emergency shelters, and food distribution. Plans have been developed to address protocol, training, and prioritization of patient evacuation from damaged hospitals. The plans also include identifying destinations for the evacuated patients. Local health departments have developed plans to address public health issues after the incident and coordinated with local emergency management to address the needs of medically fragile individuals within shelters.

## Scenario Description[D]

A magnitude 8.0[6] earthquake strikes along the San Andreas Fault zone in the San Francisco Bay Area. Intense ground shaking extends throughout large sections of the Bay Area, drastically impacting communities in several regions with a combined population of approximately one million people. Sub-surface faulting occurs along 30 miles of the fault zone extending toward heavily populated local jurisdictions, creating massive destruction. The earthquake causes a rupture along San Francisco's water resources, including damage to underground pipes and tunnels, which results in flooding in certain areas.

An area within 20 miles of the epicenter is subjected to intense shaking, causing significant damage to buildings and falling debris. Ruptured gas lines have caused widespread urban and rural fires. First responders and emergency hospital systems estimate 5,000 immediately killed, 100,000 critically injured, with more critical hospitalizations and fatalities to be determined. More than 20,000 individuals across several counties have reported minor injuries not requiring hospitalization. Thousands remain unaccounted for and potentially trapped. Additionally, soil liquefaction has resulted in severe destabilization of many structures, including hospitals and sites designated for hospital surge. Healthcare facilities closest to the epicenter are unable to provide care to the injured due to substantial damage to their infrastructure. Extensive damage to the transportation system impedes emergency response and prevents thousands of commuters from reaching home. Several aftershocks registering between 6.5 and 7.0 on the Richter scale occur throughout the day along fault lines stretching from San Francisco to Sacramento and surrounding regions. This causes levees to be partially breached, with localized flooding along the Sacramento River, adding onerous challenges for emergency healthcare providers.

The earthquake and aftermath disrupt normal life and businesses throughout the region for months, resulting in widespread social distress amongst affected areas. The city's resources are severely impacted, requiring the need of outside assistance to aid in providing medical and public health care. Shelter space for the displaced and alternate care sites for the injured are limited in the Bay Area because of damage to schools and community centers. Flooded communities in the Sacramento area take months to recover. Water for drinking and fire fighting is scarce immediately after the earthquake because of pipeline breaks. Utilities, including power and natural gas services are severely disrupted, and telephone, cellular and radio communications are sporadic and limited. Untreated wastewaters pollute soils throughout the area. Waterways are contaminated due to sewer line breaks throughout the region.

[6] A Magnitude 8.0 would correspond to the release of about 31 times more energy than the magnitude of the Loma Prieta earthquake measured at 6.9 on the Richter scale. (Source: USGS National Earthquake Information Center).

## Estimated Consequences (For Discussion purposes only)

| | |
|---|---|
| Casualties | 16,000 total fatalities; 250,000 total critically injured |
| Infrastructure Damage | 40,000 buildings destroyed, 400,000 buildings damaged |
| Evacuations/ Displaced Persons | • 200,000 homes destroyed<br>• 300,000 seek shelter in safe areas<br>• 250,000+ self-evacuate |
| Contamination | From hazardous materials, in some areas within one week |
| Economic Impact | Severe |
| Potential for Multiple Incidents | Yes, aftershocks |
| Recovery Timeline | Months to years |

Table 6 - Estimated Consequences for an Earthquake

| Use-Case No. | 1 |
|---|---|
| Name | MG |
| Age | Adult |
| Health Status | Well |
| Gender | Female |
| Marital Status | Married |
| Financing | Insured |
| Language | Spanish |
| Special Needs | Dog Owner |
| Legal Status | US Resident |
| Geographic | Urban |
| Socio-Econ. Status | Middle Income |
| Race | Hispanic |
| Religious Affiliation | Catholic |

## Use-Case # EQ.MG (Earthquake / Floods / Fires)

MG, a 29-year-old Hispanic adult living in San Francisco, is in her third floor apartment cooking dinner. Her husband is out of town on a business trip. The television is on in the background. Her German Shepherd, Bella, is barking continuously, prompting MG to calm her. Within moments, the ground begins to shake intensely. MG's light fixtures and cabinets begin to tremble. Glass and windows start shattering throughout the apartment. A fast spreading fire breaks out in the kitchen. The ceiling in her apartment begins to crack, which causes wood beams and plaster to fall. The roof collapses and MG is pinned under the debris. Shortly thereafter, her entire apartment building collapses and large bricks fall on MG, causing crush injuries to her leg and multiple abrasions. Both MG and Bella are trapped in the rubble.

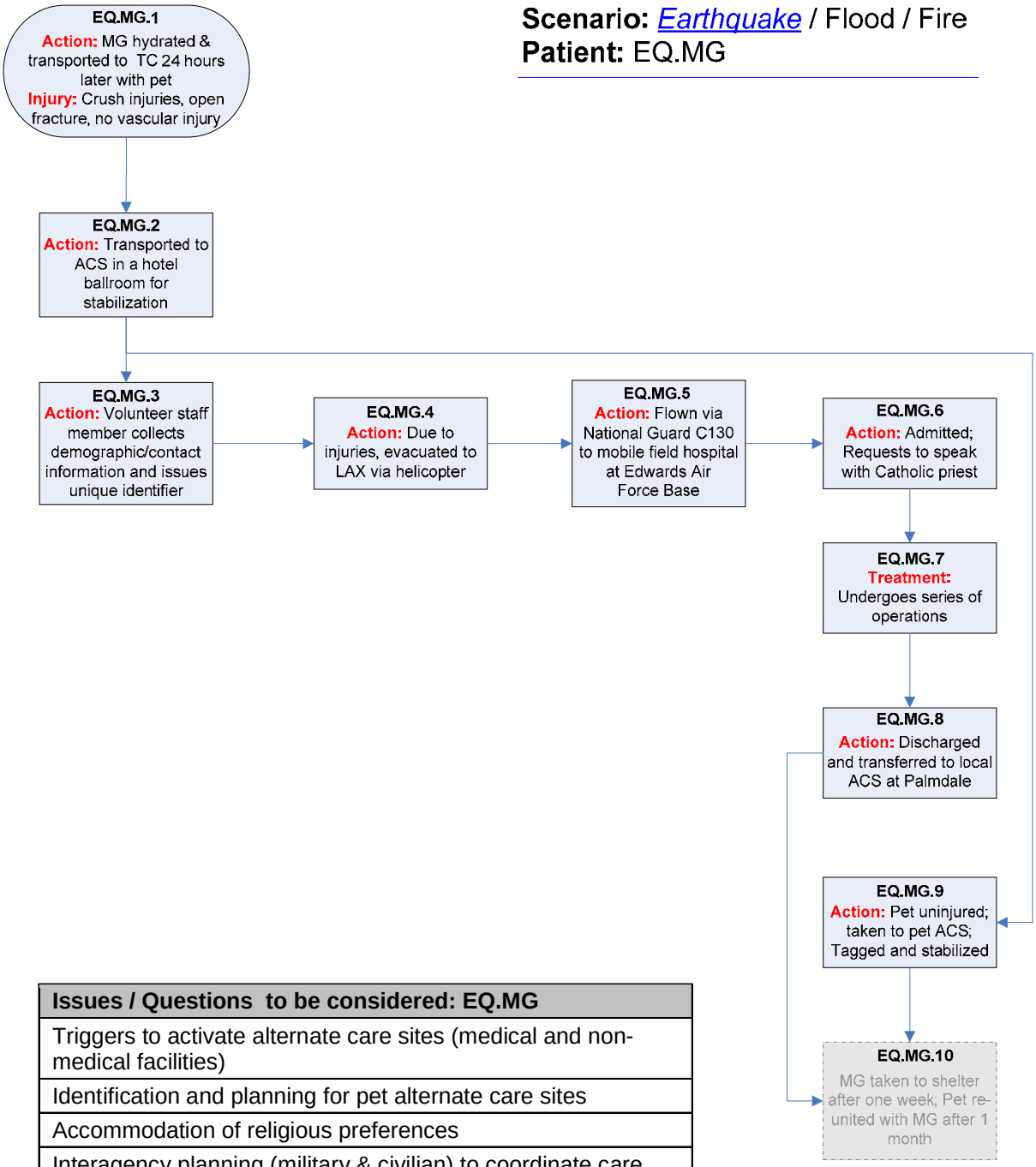
Due to extensive infrastructure damage across the region, it is twenty-four hours before emergency response teams arrive on the scene. MG is adequately hydrated prior to her extrication from the rubble and both she and Bella are transported to a triage center. There, her leg injury is quickly determined to be an open fracture with no obvious vascular injury. Bella appears to be uninjured other than minor abrasions and is taken to a pet alternate care site (ACS). MG is transferred to an ACS in a hotel ballroom for stabilization and treatment. A volunteer staff member collects her demographic and contact information (including next-of-kin and primary care provider). MG then receives a unique identifier which will be used to track and maintain her medical information during surge.

Due to the extent of her leg injury, it becomes clear that MG will eventually need orthopedic surgery. She is taken to a nearby helipad where she is flown outside the immediately affected area to Los Angeles International Airport (LAX). From there she is flown by a National Guard C-130 to a mobile field hospital set up outside the earthquake zone at Edwards Air Force Base. Before she undergoes a series of operations, she requests to speak with a Catholic priest. After initial treatment, she is transferred to an ACS in Palmdale. After a week, she has recovered sufficiently to be sent to a shelter. A month later, she is reunited with Bella.

*See next page for clinical flow.*

# Scenarios and Use Cases

**Scenario:** *Earthquake* / Flood / Fire
**Patient:** EQ.MG




| Issues / Questions to be considered: EQ.MG |
|---|
| Triggers to activate alternate care sites (medical and non-medical facilities) |
| Identification and planning for pet alternate care sites |
| Accommodation of religious preferences |
| Interagency planning (military & civilian) to coordinate care |

**Legend and Acronyms**:

| | | | |
|---|---|---|---|
| TC: | Triage Center | ACS: | Alternate Care Site |
| ICU: | Intensive Care Unit | EMR: | Electronic Medical Records |

- - - -: Process step outside of healthcare system

*Text*: Event within the scenario that impacts the use case

Figure 5. Earthquake: MG Clinical Flow

| Use-Case No. | 2 |
|---|---|
| Name | RK |
| Age | Child |
| Health Status | Asthmatic |
| Gender | Male |
| Marital Status | Single |
| Financing | No Insurance |
| Language | Indonesian (arrived 2 months ago) |
| Special Needs | Language Barrier |
| Legal Status | Undocumented |
| Geographic | Urban |
| Socio-Econ. Status | Low Income |
| Race | Asian |
| Religious Affiliation | Muslim |

## Use-Case # EQ.RK (Earthquake / Floods / Fires)

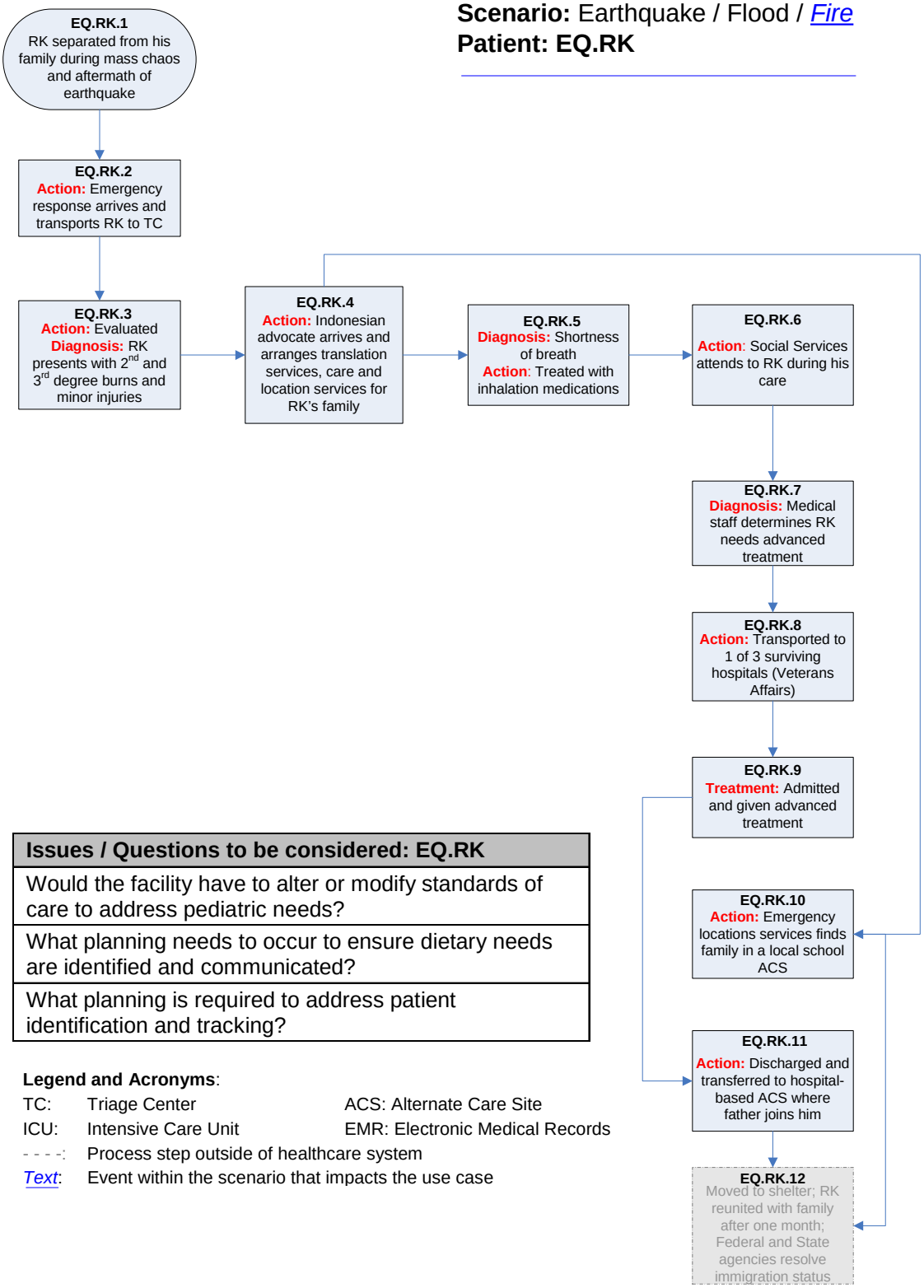
RK, a 4-year-old Indonesian-speaking Muslim is eating dinner. His older sibling is on the couch listening to music. His father is installing a ceiling fan in the living room. Suddenly, the ground begins to shake with increasing intensity every second. The structurally unsound apartment this family of four lives in begins to collapse and burn. RK is injured when a large piece of the ceiling falls on him.

During the aftermath of the earthquake, RK is separated from this family. A few hours later, emergency response teams arrive on the scene. The team is able to remove RK from the rubble and transport him to a local triage center. RK is evaluated and diagnosed with second and third degree burns on 20% of his legs along with minor cuts and scratches. RK speaks little to no English. Translation services are arranged and Social Services are contacted. Soon, an Indonesian patient advocate arrives to assess the situation and plans for his care. The advocate then contacts the State's emergency location services to connect RK to his family. At the same time, RK grows increasingly short of breath and is treated with inhalation medications. Social Services attends to him during his care.

The medical personnel determine that RK's burns will require advanced treatment. He is transported to one of three surviving hospitals in the greater San Francisco area, a Veterans Affairs Hospital. Concurrently, emergency location services finds the family in another ACS, located in a school. One week later, RK is moved to a new hospital-based ACS where his father joins him to assist in ongoing burn therapy. A month later, RK and his father rejoin their family in a shelter where Federal and State agencies coordinate to resolve the family's immigration status.

*See next page for clinical flow.*

**Scenario:** Earthquake / Flood / *Fire*
**Patient: EQ.RK**




| Issues / Questions to be considered: EQ.RK |
|---|
| Would the facility have to alter or modify standards of care to address pediatric needs? |
| What planning needs to occur to ensure dietary needs are identified and communicated? |
| What planning is required to address patient identification and tracking? |

**Legend and Acronyms**:

TC: Triage Center
ICU: Intensive Care Unit
ACS: Alternate Care Site
EMR: Electronic Medical Records
- - - -: Process step outside of healthcare system
*Text*: Event within the scenario that impacts the use case

Figure 6. Earthquake: RK Clinical Flow

| Use-Case No. | 3 |
|---|---|
| Name | AA |
| Age | Teen |
| Health Status | 30 weeks Pregnant/ Gestational Diabetic/ HIV+ |
| Gender | Female |
| Marital Status | Single |
| Financing | Medi-Cal |
| Language | English |
| Special Needs | 30 weeks Pregnant |
| Legal Status | US Citizen |
| Geographic | Juvenile Detention Center |
| Socio-Econ. Status | Low Income |
| Race | Native American |
| Religious Affiliation | Native American Spirituality |

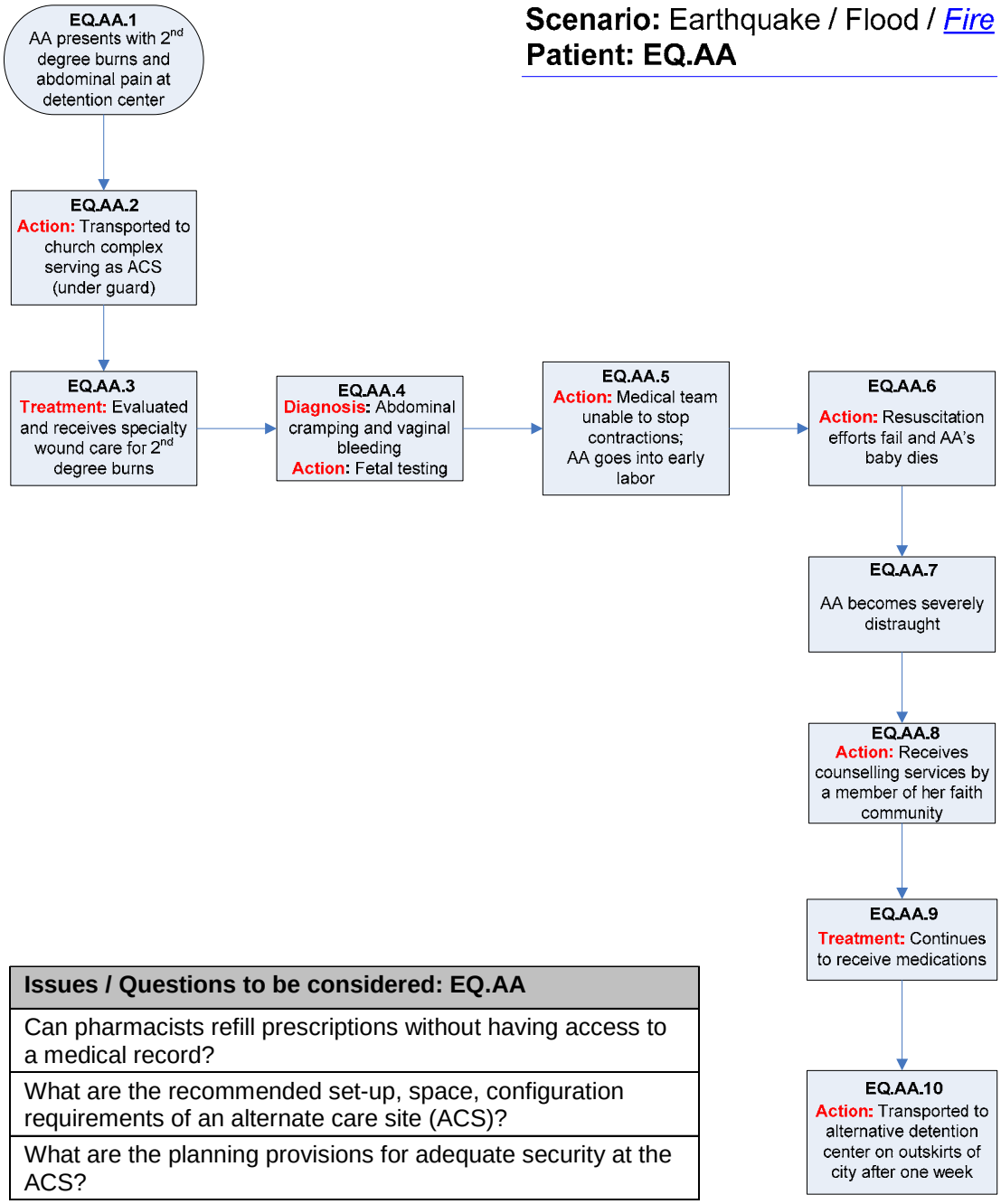
## Use-Case # EQ.AA (Earthquake / Floods / Fires)

AA, a 17-year-old Native American, who is 30-weeks pregnant, is incarcerated in a local juvenile detention center outside of the San Francisco Bay Area. She is being held overnight for an alleged crime. AA starts yelling at a security officer that she needs her medicine for her diabetes and HIV. All of a sudden, the building starts to shake violently and she hears the sound of tempered glass cracking. A gas explosion at the detention center starts a fire and facility personnel begin evacuation procedures. Detainees begin screaming that they want to be released immediately.

AA sustains minor burns from the gas fire in the detention center. As she is being evacuated, AA falls down a flight of stairs and begins complaining of abdominal pain. She and her other cellmates are transported to a church complex serving as an ACS (under guard). AA is evaluated and found to have second degree burns over her arms and back, which will require specialty wound care. Later, she develops abdominal cramping and vaginal bleeding, indicating possible fetal distress. AA starts having contractions and goes into early labor. The medical team is unable to stop the contractions, thus delivering a significantly distressed baby. Resuscitation efforts fail in attempting to revive the baby, and within five minutes, AA's baby dies. The baby is taken away to a mortuary site. AA is left severely distraught due to the death of her baby. While at the ACS, AA receives counselling services and visits by a member of her faith community. She continues to receive her HIV medication and after one week, she is returned to a secure alternative detention center.

*See next page for clinical flow.*

**Scenario:** Earthquake / Flood / *Fire*
**Patient: EQ.AA**




| Issues / Questions to be considered: EQ.AA |
|---|
| Can pharmacists refill prescriptions without having access to a medical record? |
| What are the recommended set-up, space, configuration requirements of an alternate care site (ACS)? |
| What are the planning provisions for adequate security at the ACS? |

**Legend and Acronyms**:

TC: Triage Center — ACS: Alternate Care Site
ICU: Intensive Care Unit — EMR: Electronic Medical Records
- - - -: Process step outside of healthcare system
*Text*: Event within the scenario that impacts the use case

Figure 7. Earthquake: AA Clinical Flow

| Use-Case No. | 4 |
|---|---|
| Name | EB |
| Age | Middle Age (55 years) |
| Health Status | Coronary Heart Disease, Renal Failure, Diabetes and Dialysis |
| Gender | Male |
| Marital Status | Divorced |
| Financing | Insured (Military Retiree) |
| Language | English |
| Special Needs | Leg Amputee |
| Legal Status | US Citizen visiting from Miami |
| Geographic | Urban |
| Socio-Econ. Status | Middle Income |
| Race | African American |
| Religious Affiliation | Unique Religious Needs (Blood, Medicines) |

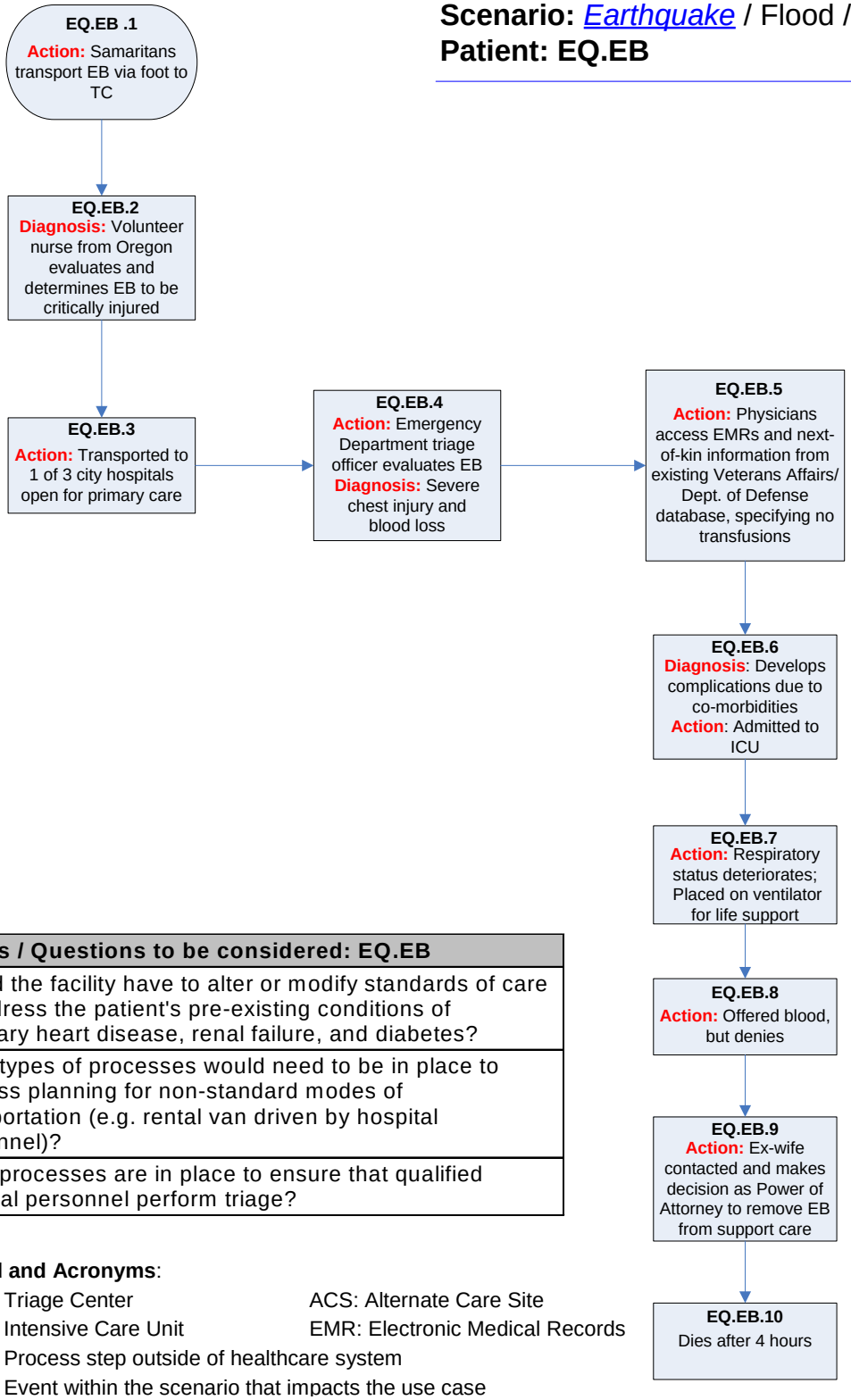
## Use-Case # EQ.EB (Earthquake / Floods / Fires)

EB, a 55-year old wheelchair-bound retired veteran, is visiting friends in San Francisco. He takes his medicine for heart disease and diabetes. After making an appointment for dialysis in Los Angeles, EB heads down to the hotel lobby for dinner. He is shown to a table and places his order, when the ground begins to shake. As the shaking continues for several seconds, EB rolls himself in his wheelchair to an inner wall to avoid flying glass and falling light fixtures. The shaking is so intense that the wall subsequently collapses on him.

A hotel staff member pulls EB out of the rubble and drags him to the entrance. After approximately 30 minutes, EB finds himself being carried on a table for several hundred yards to a triage center. A volunteer nurse from Oregon quickly evaluates EB to be critically injured. EB is immediately transported to one of three functioning city hospitals. At the entrance to the emergency department, the triage officer suspects that EB has a severe chest injury and massive blood loss from large lacerations on his left leg. EB is in and out of consciousness. Physicians at the hospital are able to access EB's electronic medical records via the existing Veterans Affairs / Department of Defense database, which includes his advanced directive that specify no transfusions. In addition, his ex-wife's contact information, who is listed as next-of-kin, is power of attorney in the event of an emergency. Given EB's diminished lung capacity, complicated by co-morbid health conditions, he is admitted to the ICU and placed on a ventilator for life support where his respiratory status continues to deteriorate. He is offered a blood transfusion, however denies this procedure. His ex-wife is contacted in Miami and asked to make the decision of removing EB from life support care. She is informed of his condition and chances for survival, and consequently decides to give the medical personnel authority to discontinue life support. Four hours later, EB dies.

*See next page for clinical flow.*

**Scenario:** *Earthquake* / Flood / Fire
**Patient: EQ.EB**




| Issues / Questions to be considered: EQ.EB |
|---|
| Would the facility have to alter or modify standards of care to address the patient's pre-existing conditions of coronary heart disease, renal failure, and diabetes? |
| What types of processes would need to be in place to address planning for non-standard modes of transportation (e.g. rental van driven by hospital personnel)? |
| What processes are in place to ensure that qualified medical personnel perform triage? |

**Legend and Acronyms**:

TC: Triage Center
ICU: Intensive Care Unit
ACS: Alternate Care Site
EMR: Electronic Medical Records
- - - -: Process step outside of healthcare system
*Text*: Event within the scenario that impacts the use case

Figure 8. Earthquake: EB Clinical Flow

| Use-Case No. | 5 |
|---|---|
| Name | JP |
| Age | Frail Elderly (85 years) |
| Health Status | Alzheimer's (Nursing Home / Home Care) |
| Gender | Female |
| Marital Status | Single |
| Financing | Medicare |
| Language | English |
| Special Needs | Vision / Hearing Impaired |
| Legal Status | US Citizen |
| Geographic | Rural |
| Socio-Econ. Status | High Income (US Senator's mom - high visibility patient) |
| Race | Caucasian |
| Religious Affiliation | Protestant |

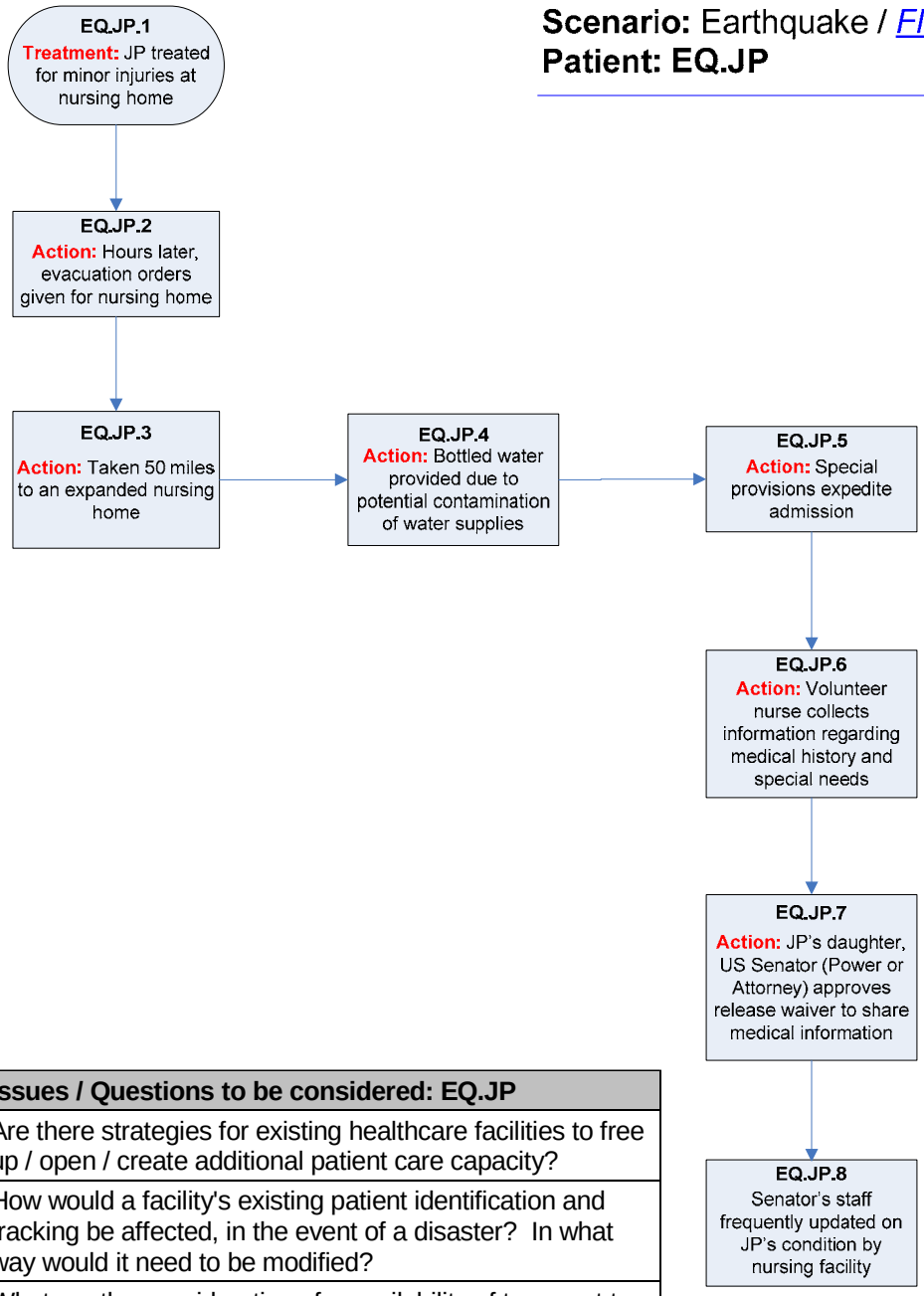
## Use-Case # EQ.JP (Earthquake / Floods / Fires)

JP, an 85-year-old frail elderly Alzheimer's patient, lives in a skilled nursing home in a rural area north of Sacramento. She is also vision and hearing impaired. JP suddenly realizes that the marble floor beneath her is shaking. As JP reaches to grab her fallen reading glasses, one of the windows in her room shatters causing minor scrapes on her arms.

Although the facility shook considerably, it remains structurally intact due to retrofitting that was required after the Loma Prieta earthquake in 1989. JP is treated for her minor injuries at the nursing home. Later that evening, an aftershock damages the levee system and orders are given to evacuate the nursing home. JP is transported 50 miles to a nursing home site that has been expanded to accommodate additional patients beyond its normal capacity. Bottled water is provided to patients due to disruption and potential contamination of water supplies. Special provisions have been made for JP to expedite her transfer and admission to the nursing home site. Upon arrival, a volunteer nurse collects information regarding JP's medical history and special needs from her medical records. JP's daughter, a U.S. Senator, who is the Power of Attorney for her mother, approves the release of medical information to be disclosed to her staff members. The Senator's staff is frequently updated on JP's condition by the nursing facility.

*See next page for clinical flow.*

**Scenario:** Earthquake / *Flood* / Fire
**Patient: EQ.JP**




| Issues / Questions to be considered: EQ.JP |
|---|
| Are there strategies for existing healthcare facilities to free up / open / create additional patient care capacity? |
| How would a facility's existing patient identification and tracking be affected, in the event of a disaster? In what way would it need to be modified? |
| What are the considerations for availability of transport to rural areas? |

**Legend and Acronyms**:

TC: Triage Center
ICU: Intensive Care Unit
ACS: Alternate Care Site
EMR: Electronic Medical Records
- - - -: Process step outside of healthcare system
*Text*: Event within the scenario that impacts the use case

Figure 9. Earthquake: JP Clinical Flow

# Section III: Scenario - Nuclear Explosion Resulting in Burns, Traumatic Injuries, Irradiation and Radionuclear Contamination[7]

## California's Healthcare Surge Preparedness for a Nuclear Incident

Plans and procedures are in place for most effective lifesaving activities, specifically those that address:

- The evacuation or sheltering-in-place decisions for potential victims in the immediate fallout path;
- Effective communication of instructions to the affected population;
- Effective delivery of medical / trauma care to affected population;
- The efficient decontamination of the evacuated population.

Exercises have been conducted to ensure efficient screening, containment of contaminated area, medical triage, and decontamination of people exiting the blast and fallout areas. Timely mass triage and medical care for acutely traumatized and burned individuals will drastically reduce casualties.

To adequately address the care and treatment of victims, trained medical healthcare workers from outside the affected area will be called upon through the mutual aid system and Medical Reserve Corps. Post-nuclear detonation response activities include:

- Implementing medical triage, treatment, and stabilization of casualties;
- Treating walk-in victims and performing patient screening (for injuries and radiation) and decontamination;
- Making policy decisions such as when and where to administer radionuclide countermeasures to the affected populations and then determining how to operationalize these decisions;
- Transporting injured patients and reporting patient status to required authorities;
- Collecting and identifying human remains (coroner and morgue functions, including the potential for remains to be residually radioactive) and providing next-of-kin notifications.

The State Emergency Medical System rapidly assesses the extent of radiation and creates decontamination centers and population treatment centers throughout the regions. These centers are able to diagnose, treat, and track radiation exposed patients, in addition to providing both supportive and intensive care based on healthcare needs. A key service provided by the government is the documentation of calculated dosage of radiation and placement in a registry to allow for long-term follow-up care. Additionally, emergency communication and transportation systems are established to replace those damaged by the electromagnetic pulse. Effective care delivery and the continuous transmission of strategic messages on the effects of radiation calm a large percentage of the public, which alleviates the strain on the healthcare system as it surges to accommodate tens of thousands of people who were burned, injured contaminated, and exposed to varying amounts of radiation. Patients are reminded not to eat, drink, or smoke, in order to help reduce the risk of self contamination.

[7] Although blast and trauma are the biggest outcomes from a nuclear explosion, the use cases in this scenario primarily address radiation poisoning within and outside the epicenter of the blast.

## Scenario Description[E]

It is a clear sunny morning in the downtown business district of Los Angeles. Over 400 property owners begin opening their businesses. Commuters travelling to downtown for work, pack the metro lines at Pershing Square, Civic Center and Staples Center.

At 9:30 am, a truck enters the densely populated area in the financial district of downtown. Within seconds, the truck driver detonates a 10-kiloton nuclear device. Immediately within a mile radius from ground zero, thousands are killed in an instant vaporization. Intense heat from the explosion and blast wave causes widespread fires within the immediate blast area, severely damaging and destroying homes and commercial buildings. As a result, thousands more are injured from flying debris and thermal burns. An electromagnetic pulse resulting from the blast, damages all power, computer-based, and telephone systems, and severely disrupts transportation and communication systems within several miles of ground zero.

A mushroom cloud rises above the city and begins to drift south-southeast. The effects of the explosion include blast, severe heat, and fatal radiation exposure close to ground zero. There is also a wide radiation dispersion from 1 to 30 Sv[8], with the higher doses concentrated within a 10 mile radius from the blast site. Widespread concerns over the radiation, hyped by rumors, breaks out, sending tens of thousands streaming from the contaminated zone and overloading emergency departments and overwhelming healthcare facilities. City hospitals, police precincts, and firehouses are completely destroyed within a two mile radius of ground zero and blast damage and fires seriously tax the remaining emergency responders. Bodies litter the streets everywhere. Rumors abound that these dead bodies are spreading disease. Public utilities, including water, gas, electricity, and sewage systems are severely disrupted, leaving several areas around the city without water, power, communication and limited transportation. Emergency workers outside of the city are delayed from helping until the extent of radioactive contamination is determined and communicated. Rescue efforts are initially hampered by the need for respiratory equipment. The city's resources are severely impacted, requiring the need of outside assistance to aid in providing medical and public health care.

## Estimated Consequences (For Discussion purposes only)[9]

| | |
|---|---|
| Casualties | 75,000 fatalities; 150,000 injuries / radiation exposed |
| Infrastructure Damage | Total within radius of 0.5 to 3 miles |
| Evacuations/ Displaced Persons | • 100,000 in affected area seek shelter in safe areas,<br>• Decontamination required for all before entering shelters<br>• 250,000 instructed to shelter-in-place as plume moves across region(s)<br>• 1,000,000+ self-evacuate from major urban areas |
| Contamination | Various levels up to approximately 3,000 square miles |
| Economic Impact | Severe |
| Potential for Multiple Incidents | Yes; Fires |
| Recovery Timeline | Years |

Table 7 - Estimated Consequences of a Nuclear Explosion

[8] The Sievert (symbol: Sv) is the SI derived unit of dose equivalent. It attempts to reflect the biological effects of radiation as opposed to the physical aspects, which are characterized by the absorbed dose, measured in grays.
One Sievert is a large dose. The recommend threshold limit value is an average annual dose of 0.05 Sv. The effects of being exposed to large doses of radiation at one time (acute exposure) vary with dose. Below are some examples:
10 Sv-Risk of death within days or weeks
1 Sv-Risk of cancer later in life (5 in 100)
[9] Estimated numbers based on Department of Homeland Security, National Planning Scenarios

## Use-Case # NE.MG (Nuclear Explosion)

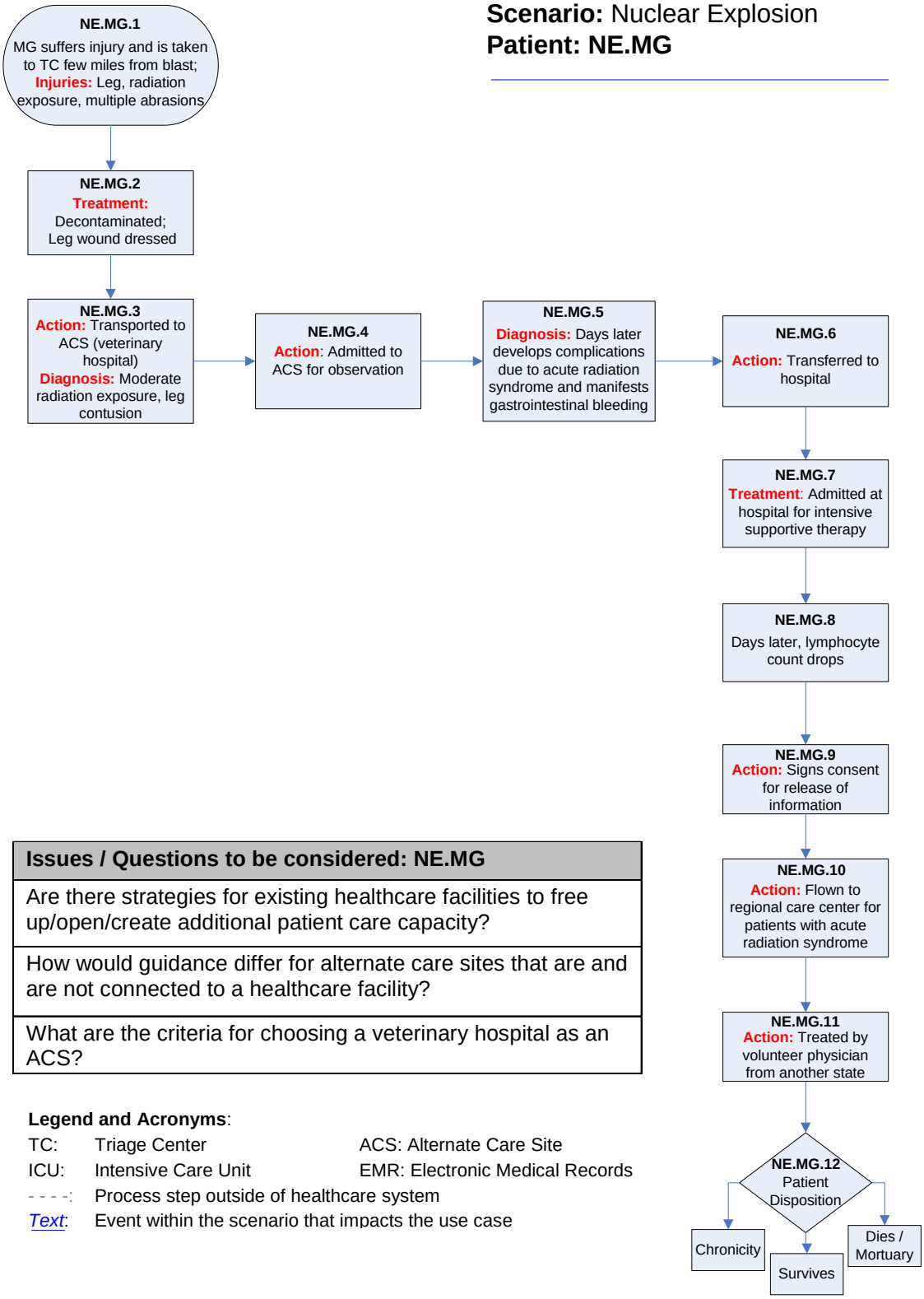
| Use-Case No. | 1 |
|---|---|
| Name | MG |
| Age | Adult |
| Health Status | Well |
| Gender | Female |
| Marital Status | Married |
| Financing | Insured |
| Language | Spanish |
| Special Needs | Dog Owner |
| Legal Status | US Resident |
| Geographic | Urban |
| Socio-Econ. Status | Middle Income |
| Race | Hispanic |
| Religious Affiliation | Catholic |

At 8:30 am, MG, a 29-year old Hispanic woman, boards the Metro Red Line that takes her into the downtown Los Angeles financial district where she works at a computer store on Fifth Street. At 8:45am she exits the train at the Pershing Square station. At 9:30am, a large explosion causes window panes of surrounding buildings to shatter and structures to crumble. MG is working on inventory in the basement at the time of the blast. Her store suffers damages from the effect of the explosion, heat and radioactive contamination by dust. MG sustains a leg injury and multiple abrasions from being thrown against the wall.

MG is disoriented and has no idea what just happened. She emerges from the rubble and drags herself outside where she sees a group of firemen who then take her to a triage center set up a few miles away. At the triage center her clothing is removed and she undergoes skin decontamination and her leg wound is dressed. MG is then taken to a nearby ACS located in a veterinary hospital, which has been designated and equipped to be a radiation patient receiving center. At the ACS, she is provisionally diagnosed with a leg contusion. Based on the location of her store and the time elapsed until decontamination, it is determined she has received moderate radiation exposure. She is admitted to the ACS for observation. After several days at the ACS, MG begins to show signs of acute radiation syndrome and manifests gastrointestinal bleeding. She is then taken to a hospital where she is admitted for intensive supportive therapy. After several days at the hospital, her lymphocyte count begins to drop. MG signs a consent form for release of information and is then flown to a regional care center, which has been established for patients with acute radiation syndrome. She is treated by a volunteer physician from outside the State of California. There she survives, dies, or barely recovers (multiple patient dispositions for discussion purposes only).

*See next page for clinical flow.*

**Scenario:** Nuclear Explosion
**Patient: NE.MG**




| Issues / Questions to be considered: NE.MG |
|---|
| Are there strategies for existing healthcare facilities to free up/open/create additional patient care capacity? |
| How would guidance differ for alternate care sites that are and are not connected to a healthcare facility? |
| What are the criteria for choosing a veterinary hospital as an ACS? |

**Legend and Acronyms**:

| | | |
|---|---|---|
| TC: | Triage Center | ACS: Alternate Care Site |
| ICU: | Intensive Care Unit | EMR: Electronic Medical Records |
| - - - -: | Process step outside of healthcare system | |
| *Text*: | Event within the scenario that impacts the use case | |

Figure 10. Nuclear Explosion: MG Clinical Flow

| Use-Case No. | 2 |
|---|---|
| Name | RK |
| Age | Child |
| Health Status | Asthmatic |
| Gender | Male |
| Marital Status | Single |
| Financing | No Insurance |
| Language | Indonesian (arrived 2 months ago) |
| Special Needs | Language Barrier |
| Legal Status | Undocumented |
| Geographic | Urban |
| Socio-Econ. Status | Low Income |
| Race | Asian |
| Religious Affiliation | Muslim |

## Use-Case # NE.RK (Nuclear Explosion)

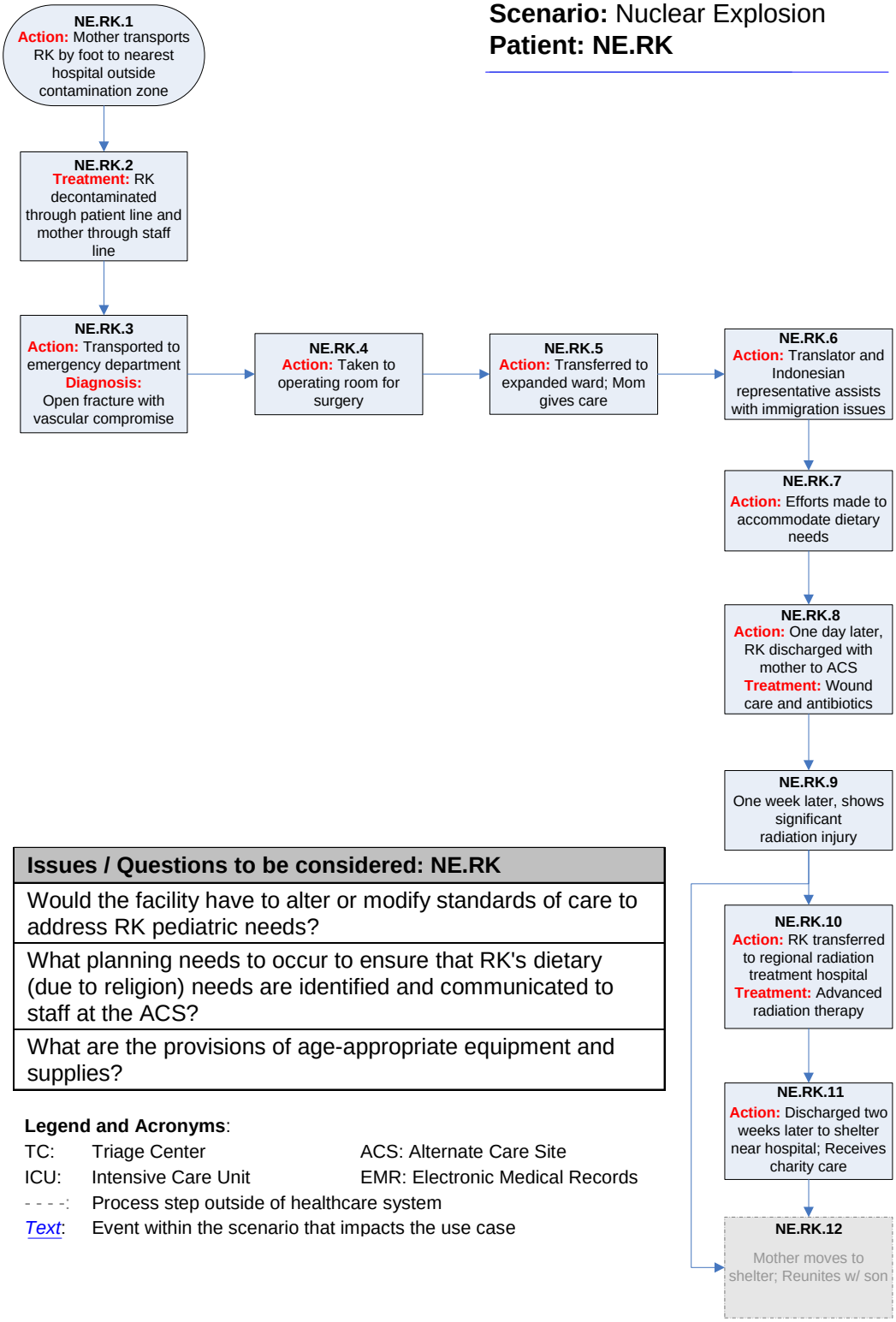
RK, a 4-year-old Indonesian-speaking Muslim, is having a late breakfast in his mother's apartment about two miles from ground zero of the blast. Due to the impact of the shockwave, the structurally unsound apartment collapses. RK sustains an open fracture to his left leg with some bleeding. His mother, barely able to speak English, manages to carry RK through crowds of people fleeing the scene. His mother reaches the nearest hospital entrance, outside the contamination zone. There, RK and his mother are decontaminated. RK passes through a patient line, while his mother passes through the decontamination line set up for staff.

In the emergency department, RK is diagnosed with an open fracture of his lower leg with significant vascular compromise. He is taken to an operating room where temporizing (damage control) surgery is performed to return blood flow to his foot and to stabilize his fracture. He is placed in an expanded ward where his mother helps provide for his care and a translator and Indonesian representative are available to assist with immigration issues and language translation. Additionally, efforts are made to accommodate RK's dietary needs due to religious preferences. After a day, he is ready for discharge. He and his mother are sent to a local ACS for wound care and antibiotic therapy. By the end of the week, RK begins showing signs of significant radiation injury. He is transferred to a regional radiation treatment site for advanced therapy. His mother remains at the ACS and is then moved to a shelter. She is later reunited with her son who is discharged two weeks later to a shelter near the referral hospital, where he receives charity care[10].

*See next page for clinical flow.*

[10] Charity Care is generally for people who do not have other financial resources available, such as insurance, government programs, or regular income. It is healthcare provided at no charge or at a reduced charge to those who meet the financial need requirements (Source: St. Joseph Hospital, Peacehealth.org)

**Scenario:** Nuclear Explosion
**Patient: NE.RK**




| Issues / Questions to be considered: NE.RK |
|---|
| Would the facility have to alter or modify standards of care to address RK pediatric needs? |
| What planning needs to occur to ensure that RK's dietary (due to religion) needs are identified and communicated to staff at the ACS? |
| What are the provisions of age-appropriate equipment and supplies? |

**Legend and Acronyms**:

| | | |
|---|---|---|
| TC: | Triage Center | ACS: Alternate Care Site |
| ICU: | Intensive Care Unit | EMR: Electronic Medical Records |
| - - - -: | Process step outside of healthcare system | |
| *Text*: | Event within the scenario that impacts the use case | |

Figure 11. Nuclear Explosion: RK Clinical Flow

| Use-Case No. | 3 |
|---|---|
| Name | AA |
| Age | Teen |
| Health Status | 30 weeks Pregnant/ Gestational Diabetic/ HIV+ |
| Gender | Female |
| Marital Status | Single |
| Financing | Medi-Cal |
| Language | English |
| Special Needs | 30 weeks Pregnant |
| Legal Status | US Citizen |
| Geographic | Juvenile Detention Center |
| Socio-Econ. Status | Low Income |
| Race | Native American |
| Religious Affiliation | Native American Spirituality |

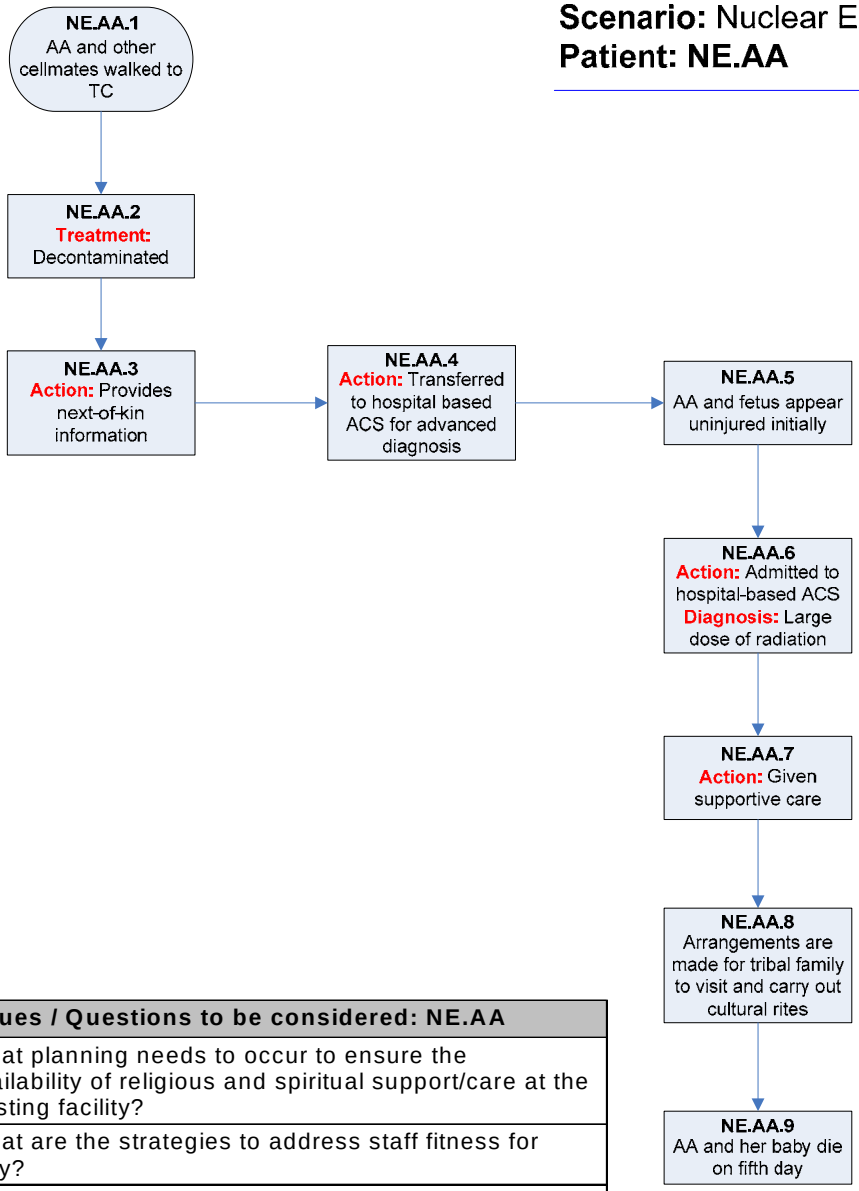
## Use-Case # NE.AA (Nuclear Explosion)

AA, a 17-year-old Native American, who is 30-weeks pregnant, is incarcerated in a local juvenile detention center. She is HIV+ and suffers from gestational diabetes. As she leans against the cell wall, a large explosion reverberates through the building. She is fairly close to the blast; however, due to the construction of the detention center and her location within the building, she receives only minor injuries.

Upon being evacuated from the building by the surviving officers, AA and two dozen other prisoners are walked to the nearest triage center (under guard). AA is completely undressed, undergoes skin decontamination and is able to provide her next-of-kin information to a patient services staff member, which is submitted into a state database. It is determined based on her proximity to the blast that she has likely received a significant dose of radiation. She is transferred to a hospital-based alternate care site (ACS) for a more thorough evaluation to obtain a better estimate of her radiation exposure. She and her fetus appear uninjured and do not seem to demonstrate any effects of radiation syndrome yet. However, at the hospital-based ACS, it is determined that she and her baby have received a large dose of radiation. She is given supportive treatment and arrangements are made for her tribal family to carry out cultural rites. AA and her baby die on the fifth day.

*See next page for clinical flow.*

**Scenario:** Nuclear Explosion
**Patient: NE.AA**




| Issues / Questions to be considered: NE.AA |
|---|
| What planning needs to occur to ensure the availability of religious and spiritual support/care at the existing facility? |
| What are the strategies to address staff fitness for duty? |
| How will modified standards of care for existing medical conditions be implemented? If the baby had been delivered and lived, provision of care to premature infant at an ACS? |
| How would appropriate medications and equipment to address existing medical conditions be provided? |

**Legend and Acronyms**:

TC: Triage Center
ACS: Alternate Care Site
ICU: Intensive Care Unit
EMR: Electronic Medical Records
- - - -: Process step outside of healthcare system
*Text*: Event within the scenario that impacts the use case

Figure 12. Nuclear Explosion: AA Clinical Flow

| Use-Case No. | 4 |
|---|---|
| Name | EB |
| Age | Middle Age (55 years) |
| Health Status | Coronary Heart Disease, Renal Failure, Diabetes and Dialysis |
| Gender | Male |
| Marital Status | Divorced |
| Financing | Insured (Military Retiree) |
| Language | English |
| Special Needs | Leg Amputee |
| Legal Status | US Citizen visiting from Miami |
| Geographic | Urban |
| Socio-Econ. Status | Middle Income |
| Race | African American |
| Religious Affiliation | Unique Religious Needs (Blood, Medicines) |

*See next page for clinical flow*.

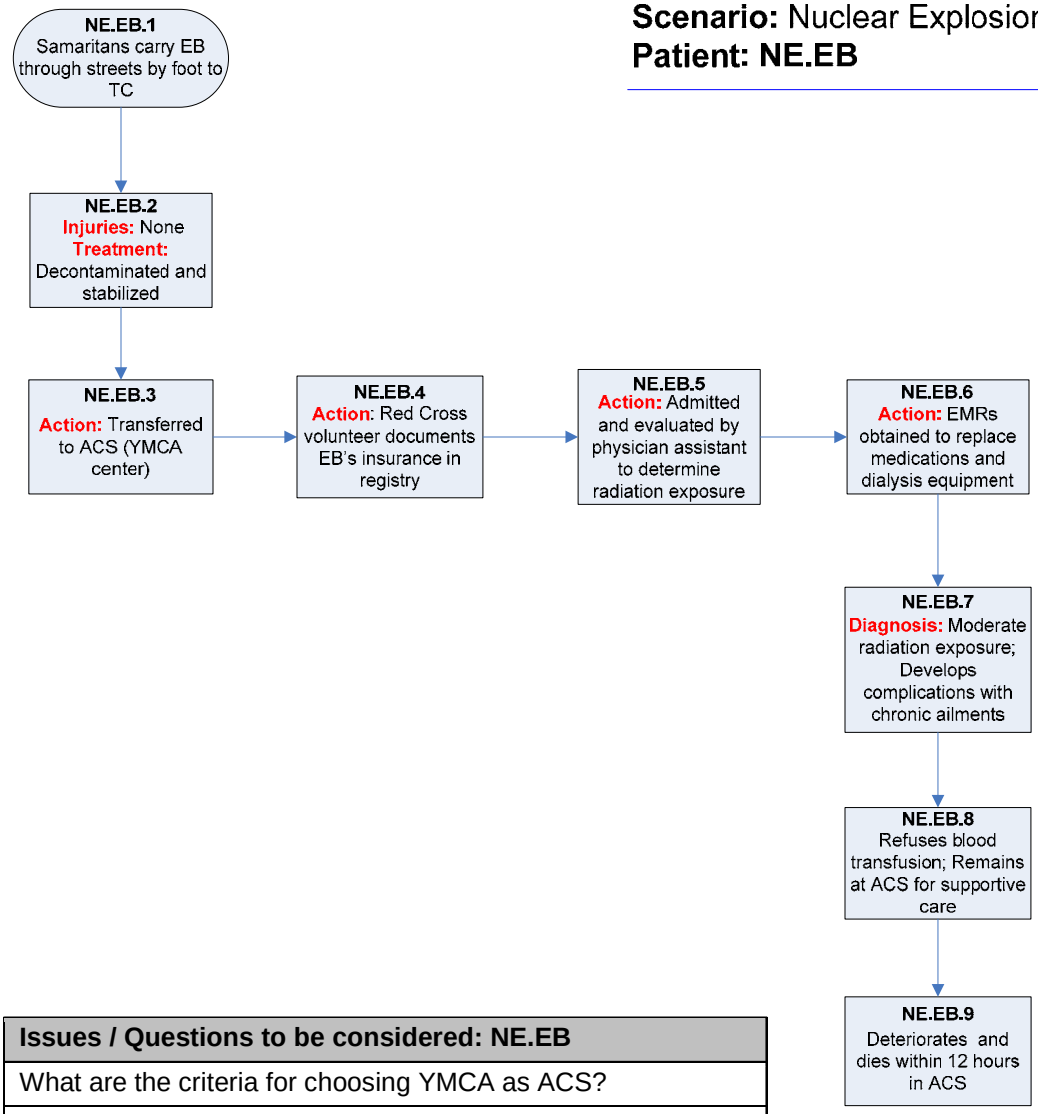
## Use-Case # NE.EB (Nuclear Explosion)

EB, a 55-year old wheelchair-bound retired veteran with end-stage renal disease is staying at a local hotel enjoying his visit to Los Angeles. He gets ready to take a tour of the city. As he prepares to leave, a resounding explosion ricochets through his room located in the interior of the hotel. He survives without injury along with several hundred staff and guests.

Unable to use his wheelchair, EB is carried by several guests and staff through the streets to the nearest triage center. He is undressed, decontaminated and sent to an ACS, located in a YMCA facility. An American Red Cross volunteer documents his insurance information in a temporary state registry, which will make medical information available to his primary provider. EB is admitted and initially evaluated by a physician assistant to determine his radiation exposure.

The ACS is able to obtain EB's electronic medical records from the Miami VA and replace his missing medications and provide replacement peritoneal dialysis equipment for his use. Although he has received only a moderate dose of radiation, his other chronic conditions complicate his clinical course. He refuses any blood transfusion or other intensive therapy, and remains at the ACS for supportive care. He rapidly deteriorates and dies within 12 hours in the ACS.

**Scenario:** Nuclear Explosion
**Patient: NE.EB**




| Issues / Questions to be considered: NE.EB |
|---|
| What are the criteria for choosing YMCA as ACS? |
| Will the facilities (existing or ACS) have the capability to provide EB with medications and equipment to address his pre-existing conditions (e.g., coronary heart disease, renal failure, diabetes)? |
| What is the process by which EB's body would be released and transported back to Miami? |

**Legend and Acronyms**:

| | | |
|---|---|---|
| TC: | Triage Center | ACS: Alternate Care Site |
| ICU: | Intensive Care Unit | EMR: Electronic Medical Records |
| - - - -: | Process step outside of healthcare system | |
| *Text*: | Event within the scenario that impacts the use case | |

Figure 13. Nuclear Explosion: EB Clinical Flow

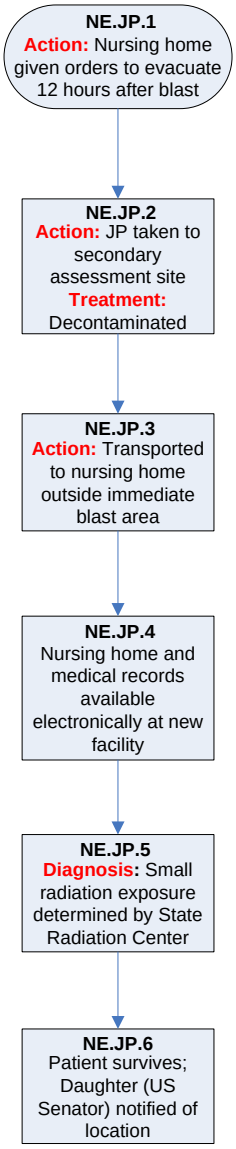
| Use-Case No. | 5 |
|---|---|
| Name | JP |
| Age | Frail Elderly (85 years) |
| Health Status | Alzheimer's (Nursing Home / Home Care) |
| Gender | Female |
| Marital Status | Single |
| Financing | Medicare |
| Language | English |
| Special Needs | Vision / Hearing Impaired |
| Legal Status | US Citizen |
| Geographic | Rural |
| Socio-Econ. Status | High Income (US Senator's mom - high visibility patient) |
| Race | Caucasian |
| Religious Affiliation | Protestant |

## Use-Case # NE.JP (Nuclear Explosion)

JP, an 85-year-old frail elderly Alzheimer's patient, lives in a skilled nursing home in a developing area south of downtown Los Angeles. She is also vision and hearing impaired. JP is in her room eating breakfast when the blast occurs several miles away. Because of her vision and hearing impairment, she is unable to orient herself. After 12 hours, residents and staff of the nursing home are instructed by the county to evacuate the facility because the wind is blowing the radiation in its direction. JP is taken to a secondary assessment site where she is undressed, decontaminated and then transported to a nursing home that is outside of contamination zone. Her medical and nursing home records are available electronically at the new site. The State Radiation Center determines that her estimated radiation exposure was small. A staff member notifies JP's daughter regarding her mother's status.

*See next page for clinical flow.*

**Scenario:** Nuclear Explosion
**Patient: NE.JP**




| Issues/Questions to be considered: NE.JP |
|---|
| What planning needs to occur to ensure that transport can accommodate patients with vision and hearing impairments? |
| What are the considerations of JP's special needs throughout transport phase? |

**Legend and Acronyms**:

| | | |
|---|---|---|
| TC: | Triage Center | ACS: Alternate Care Site |
| ICU: | Intensive Care Unit | EMR: Electronic Medical Records |
| - - - -: | Process step outside of healthcare system | |
| *Text*: | Event within the scenario that impacts the use case | |

Figure 14. Nuclear Explosion: JP Clinical Flow

# Section IV: Scenario - Pandemic Influenza

## California's Healthcare Surge Preparedness for Pandemic Influenza[F]

California's healthcare surge preparedness plans for catastrophic infectious disease incidents such as pandemic influenza or a bioterrorist attack have addressed five key issues:

- Surveillance and laboratory issues;
- Communications (including radio and television) for health risks;
- Maintenance of community services;
- Health and Medical care;
- Supply and delivery of vaccines and drugs.

Policy and strategy choices have resulted in prioritization of the pandemic influenza response from the following options:

- Reduce mortality;
- Reduce morbidity;
- Ensure continuity of essential services;
- Reduce economic effects;
- Ensure equitable distribution of resources.

Global and domestic laboratory capacity and disease surveillance capabilities have been strengthened to increase the likelihood of early disease detection and epidemiological investigation of either pandemic influenza or a bioterrorist incident.

In the initial stages of, and potentially throughout, an influenza pandemic or a bioterrorist attack, there will be a shortage of many essential resources, including medical equipment and supplies, personnel, vaccines, antivirals and drugs. Planning efforts have taken into consideration the probability of shortages. Additionally, prioritization protocols will be required for the distribution of medical resources, including who should receive vaccines and antiviral drugs first.

## Scenario Description[G]

Influenza pandemics have occurred every 10 to 60 years, with three occurring in the twentieth century (1918, 1957-1958, and 1967-1968). Influenza pandemics occur when there is a notable genetic change (termed genetic shift) in the circulating strain of influenza. Because of this genetic shift, a large portion of the human population is entirely vulnerable to infection from the new pandemic strain.

In late February, an outbreak of unusually severe respiratory illness is identified in a small village overseas. At least twenty-five cases have occurred, affecting all age groups. Twenty patients have required hospitalization at the local provincial hospital, five of whom have died from fulminant pneumonia and acute respiratory failure. Surveillance in surrounding regions is increased, and new cases begin to be identified throughout the province. Specimens collected from some patients located in the continent where the original outbreak occurred are sent to the World Health Organization (WHO) Reference Center for Influenza at the Centers for Disease Control and Prevention (CDC) in Atlanta.

The CDC determines that the isolates are from a subtype never before isolated from humans and appear to be a new variant, human-to-human communicable influenza strain. Isolates of the new strain, collected from patients in various overseas locales, are sent to the Centers for Disease Control and Prevention (CDC) to begin work on producing a reference strain for vaccine production, and influenza vaccine manufacturers are placed on alert. The influenza virus begins to make headlines in every major newspaper, and becomes the lead story on major news networks. Key U.S. Government officials are briefed on a daily basis and surveillance is intensified throughout many countries, including the United States.

Over the next two months, March and April, outbreaks begin to appear in areas over several geographically separated countries in the Far East. Although cases are reported in all age groups, young adults appear to be the most severely affected, and case-fatality rates are estimated to be between 5 - 15%. Flights from the affected regions are diverted and passengers quarantined at airports in attempts to slow the spread of the disease. States and local health jurisdictions are required by the Federal Pandemic Influenza Response Plan to intensify influenza surveillance activities and recommendations are made to implement non-pharmacological community containment measures. Vaccine manufactures have developed a vaccine and go into full production, but project a very limited supply for several months, if not longer.

Several weeks pass and heightened surveillance, isolation, and quarantine and community containment measures continue to track and slow the spread of the disease. In June and July, focal outbreaks begin to be reported in California. By late September, there is widespread occurrence of cases caused by the pandemic influenza strain. Rates of absenteeism in schools and businesses increase. Phones at physicians' offices and health departments continue to ring constantly. Police departments, local utility companies, and mass transit authorities begin to experience personnel shortages, resulting in disruption of routine services. As a result of months of planning, vaccination of healthcare workers and the influx of volunteer health staff, a majority of the state's hospitals remain prepared to deal with the large number of patients flooding the healthcare system. The Governor activates SEMS to help the state's hospitals allocate resources that have been stockpiled in various parts of the State. Elderly patients with chronic, medical conditions hesitate to leave their homes for fear of becoming seriously ill with influenza. The peak of cases occurs in late October, but a "second wave" occurs in January and February.

## Estimated Consequences (For Discussion purposes only)

| | |
|---|---|
| Casualties | At a 30% attack rate, 50% of those ill, will require outpatient medical care; 20% will require ICU care |
| Infrastructure Damage | None |
| Evacuations/ Displaced Persons | • No evacuation required<br>• Shelter-in-place or quarantine instructions given to certain highly affected areas |
| Contamination | Isolation of exposed persons |
| Economic Impact | Severe |
| Potential for Multiple Incidents | Yes, would be worldwide nearly simultaneously |
| Recovery Timeline | Several months |

Table 8 - Estimated Consequences of a Pandemic Flu

| Use-Case No. | 1 |
|---|---|
| Name | MG |
| Age | Adult |
| Health Status | Well |
| Gender | Female |
| Marital Status | Married |
| Financing | Insured |
| Language | Spanish |
| Special Needs | Dog Owner |
| Legal Status | US Resident |
| Geographic | Urban |
| Socio-Econ. Status | Middle Income |
| Race | Hispanic |
| Religious Affiliation | Catholic |

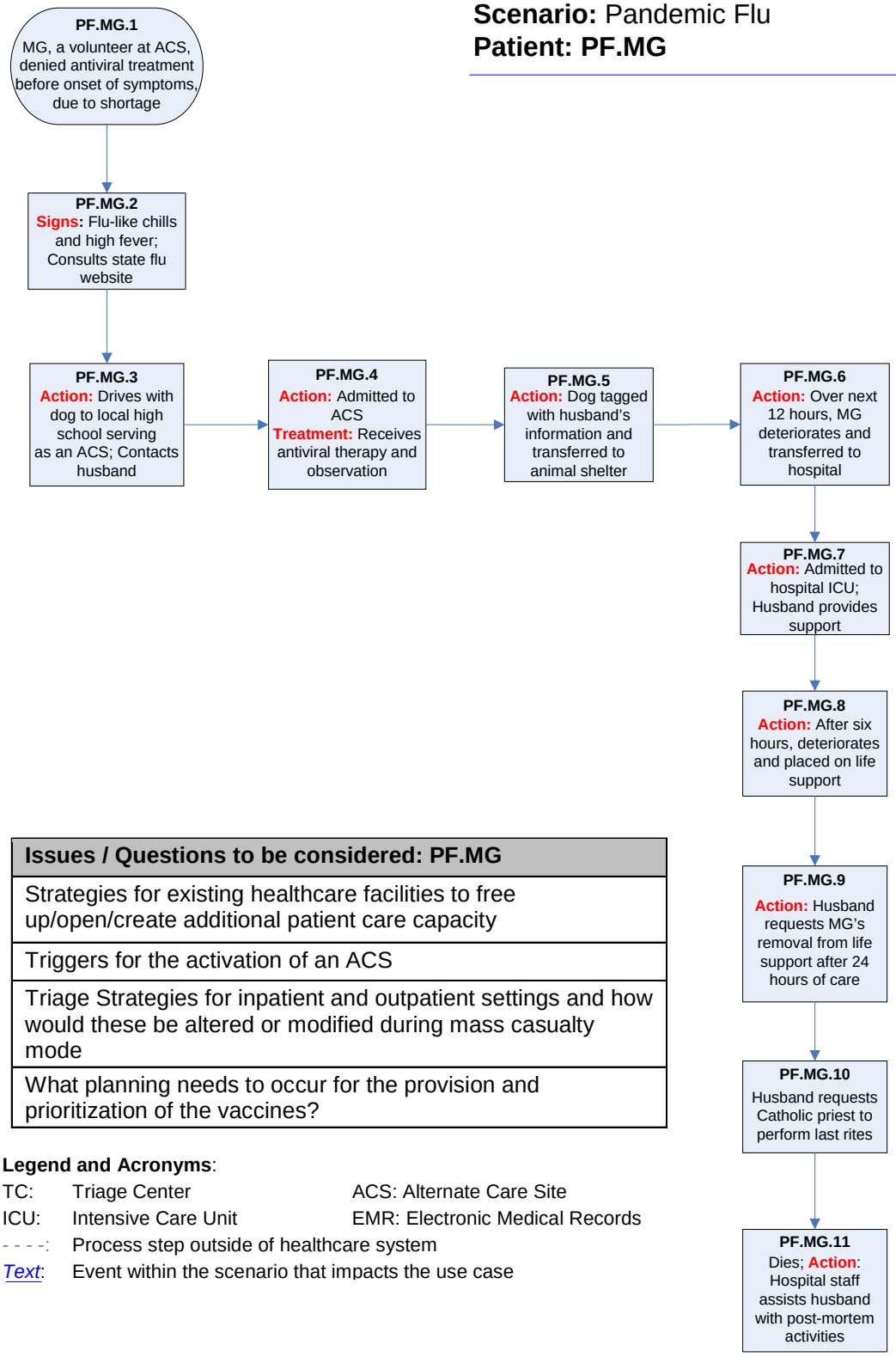
*See next page for clinical flow.*

## Use-Case # PF.MG (Pandemic Influenza)

MG, a 29-year-old Hispanic woman, is a dental hygienist volunteering at an ACS who provides translation services for patients. With the initial outbreak of pandemic flu in Asia and the activation of the local emergency response systems, she was hoping to receive a vaccination, or at least have an antiviral treatment pack. Due to shortages this did not occur. Now it is late December and she begins to develop symptoms of shaking, chills and high fever.

After checking on the State Pandemic Influenza Website, she learns that she needs an evaluation at the local school where an ACS has been established. Driving to the school with her dog, Bella, she feels increasingly ill. She calls and informs her husband at work of her location. On arrival, she is admitted along with twenty other people for antiviral therapy, symptomatic care and observation. Due to ACS regulations about pets on site, her dog is tagged with MG's name and emergency contact number of her husband and is transferred to an animal care shelter. Over the next 12 hours MG becomes increasingly ill and is transported to a hospital for admission to the ICU where her husband is with her, providing emotional support. Within six hours of admission, she continues to deteriorate and is placed on life support Husband requests a Catholic priest is called and asked to perform last rites. After 24 hours of intense supportive care, her husband makes the decision to remove her from life support care and she dies. The hospital staff assists the husband with post-mortem activities and the location of their dog.

**Scenario:** Pandemic Flu
**Patient: PF.MG**




| Issues / Questions to be considered: PF.MG |
|---|
| Strategies for existing healthcare facilities to free up/open/create additional patient care capacity |
| Triggers for the activation of an ACS |
| Triage Strategies for inpatient and outpatient settings and how would these be altered or modified during mass casualty mode |
| What planning needs to occur for the provision and prioritization of the vaccines? |

**Legend and Acronyms**:

TC: Triage Center
ACS: Alternate Care Site
ICU: Intensive Care Unit
EMR: Electronic Medical Records
- - - -: Process step outside of healthcare system
*Text*: Event within the scenario that impacts the use case

Figure 15. Pandemic Flu: MG Clinical Flow

| Use-Case No. | 2 |
|---|---|
| Name | RK |
| Age | Child |
| Health Status | Asthmatic |
| Gender | Male |
| Marital Status | Single |
| Financing | No Insurance |
| Language | Indonesian (arrived 2 months ago) |
| Special Needs | Language Barrier |
| Legal Status | Undocumented |
| Geographic | Urban |
| Socio-Econ. Status | Low Income |
| Race | Asian |
| Religious Affiliation | Muslim |

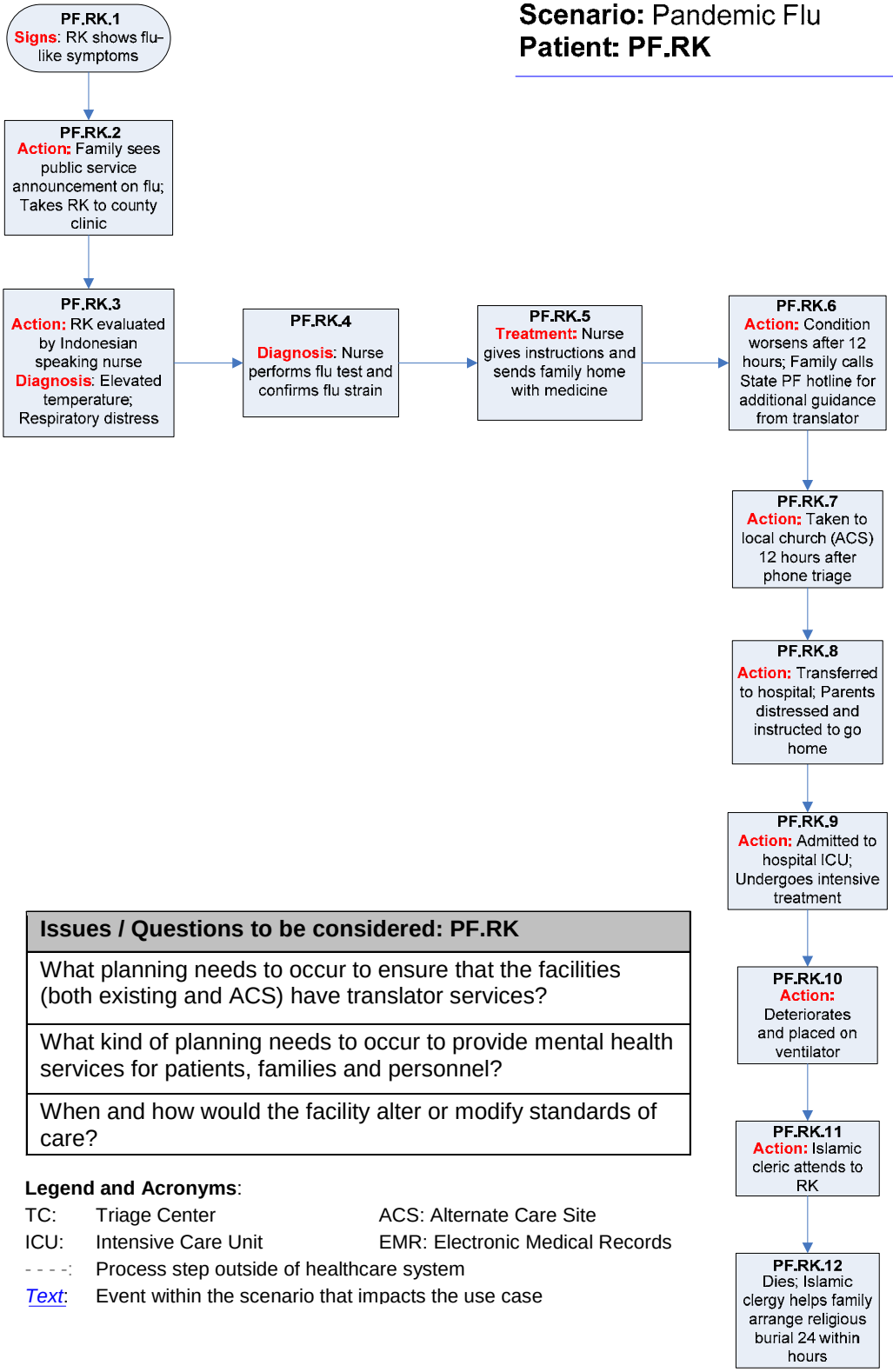
## Use-Case # PF.RK (Pandemic Influenza)

RK, a 4 year-old Indonesian-speaking Muslim boy, has been feeling sick for a few days. His concerned family has been watching the news about a possible pandemic influenza strain that has hit California. After seeing a public service announcement on television, which identifies pandemic flu symptoms similar to RK's, his family takes him to the county clinic. RK is evaluated by an Indonesian speaking nurse, who was identified from a state emergency preparedness registry, which allocates medical personnel during a disaster such as an influenza outbreak. The nurse takes his temperature and notes it to be only slightly elevated. A flu test indicates that he does have the pandemic influenza strain. With the aid of the nurse, the family is sent home for home health care with instructions and medications for RK. After being home for 12 hours, RK's condition deteriorates and he develops high fever and respiratory distress. RK's mother calls the State's pandemic flu hotline and through a translator is given instructions on supportive care and directions to the nearby ACS.

Within the hour, RK's parents take him to an ACS at a local church. Due to his prognosis, he is transferred to an acute care hospital. His family becomes significantly concerned with the rapid progression of RK's symptoms and worry about the other five children in the family. RK's mother becomes increasingly distressed, especially when she is told that she cannot go with RK to the hospital and that the family needs to return home. RK undergoes intensive treatment at the hospital including admission to the ICU and ventilator therapy. An Islamic cleric attends to him and calls the family frequently with updates. RK eventually dies. With the help of the local Islamic clergy, his family arranges a religious burial within 24 hours of his death.

*See next page for clinical flow.*

**Scenario:** Pandemic Flu
**Patient: PF.RK**




| Issues / Questions to be considered: PF.RK |
|---|
| What planning needs to occur to ensure that the facilities (both existing and ACS) have translator services? |
| What kind of planning needs to occur to provide mental health services for patients, families and personnel? |
| When and how would the facility alter or modify standards of care? |

**Legend and Acronyms**:

TC: Triage Center — ACS: Alternate Care Site
ICU: Intensive Care Unit — EMR: Electronic Medical Records
- - - -: Process step outside of healthcare system
*Text*: Event within the scenario that impacts the use case

Figure 16. Pandemic Flu: RK Clinical Flow

| Use-Case No. | 3 |
|---|---|
| Name | AA |
| Age | Teen |
| Health Status | 30 weeks Pregnant/ Gestational Diabetic/ HIV+ |
| Gender | Female |
| Marital Status | Single |
| Financing | Medi-Cal |
| Language | English |
| Special Needs | 30 weeks Pregnant |
| Legal Status | US Citizen |
| Geographic | Juvenile Detention Center |
| Socio-Econ. Status | Low Income |
| Race | Native American |
| Religious Affiliation | Native American Spirituality |

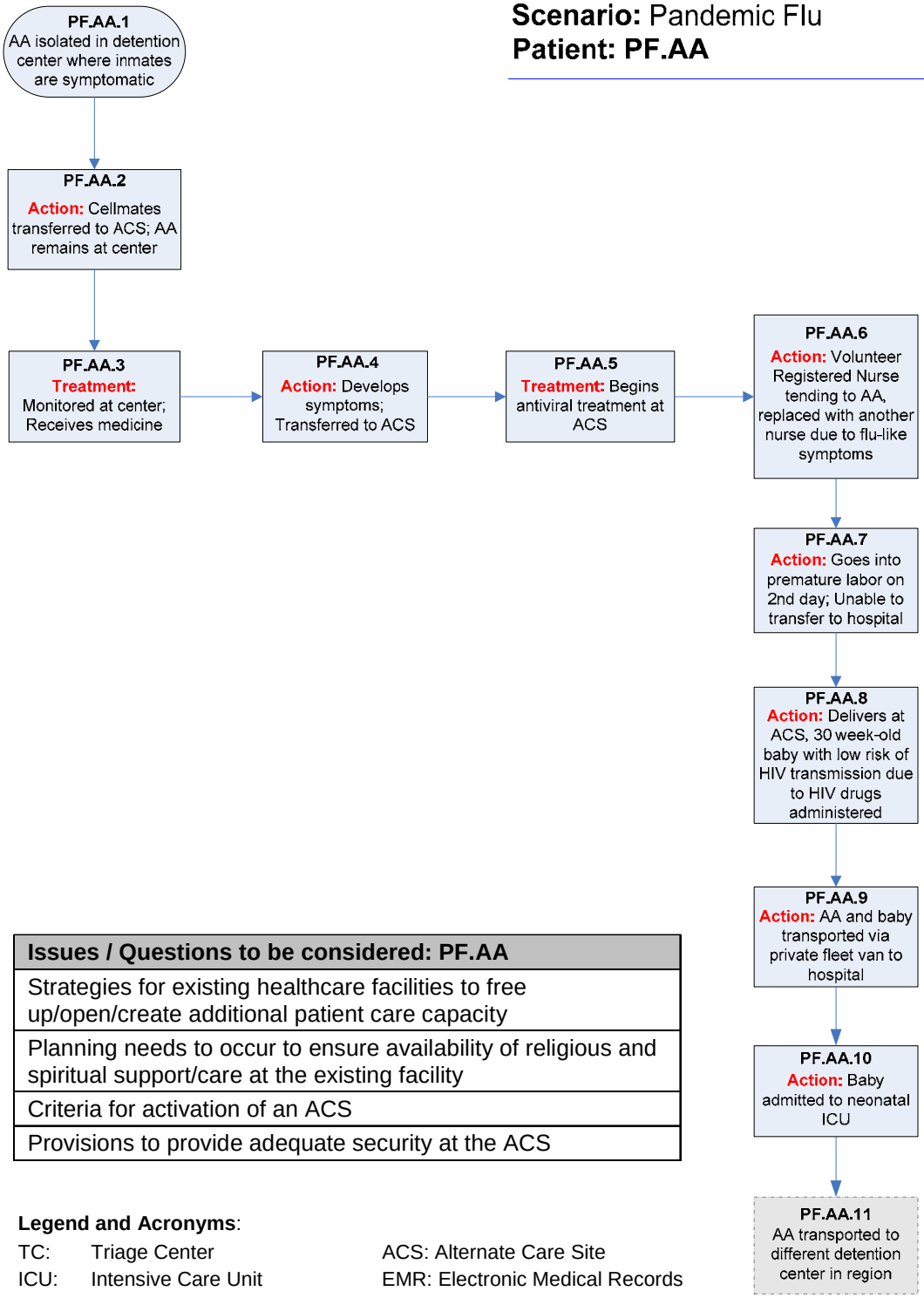
*See next page for clinical flow.*

## Use-Case # PF.AA (Pandemic Influenza)

AA, a 17-year-old Native American who is 30-weeks pregnant, has been taken to a juvenile detention center on the tribal ground where she is implicated in a crime. A week later, several individuals in the detention center are diagnosed with influenza and are taken to a local ACS. AA, however, appears to display no flu-like symptoms. She has been taking her medication for HIV and the center medical personnel continue monitoring her pregnancy status. Within hours she develops a high level fever and increased muscle pain. As AA's illness progresses she is taken to an ACS where the physician recommends that she begin antiviral treatment immediately despite some risk to the fetus.

On the first day of AA's stay, the volunteer Registered Nurse on-call begins to exhibit flu-like symptoms and is replaced so AA can continue to receive care. On the second day in the ACS, she goes into premature labor. The staff members are unable to transport her to the hospital and she has an emergency delivery in the ACS. Risk of HIV transmission to her child has been reduced due to properly administered HIV drugs. Immediately after delivery, AA and her child are transported in a private tour van to the hospital where the baby is admitted to the neonatal ICU. Two days later, AA returns to the detention center in a different region.

**Scenario:** Pandemic Flu
**Patient: PF.AA**




| Issues / Questions to be considered: PF.AA |
|---|
| Strategies for existing healthcare facilities to free up/open/create additional patient care capacity |
| Planning needs to occur to ensure availability of religious and spiritual support/care at the existing facility |
| Criteria for activation of an ACS |
| Provisions to provide adequate security at the ACS |

**Legend and Acronyms**:

TC: Triage Center
ACS: Alternate Care Site
ICU: Intensive Care Unit
EMR: Electronic Medical Records
- - - -: Process step outside of healthcare system
*Text*: Event within the scenario that impacts the use case

Figure 17. Pandemic Flu: AA Clinical Flow

| Use-Case No. | 4 |
|---|---|
| Name | EB |
| Age | Middle Age (55 years) |
| Health Status | Coronary Heart Disease, Renal Failure, Diabetes and Dialysis |
| Gender | Male |
| Marital Status | Divorced |
| Financing | Insured (Military Retiree) |
| Language | English |
| Special Needs | Leg Amputee |
| Legal Status | US Citizen visiting from Miami |
| Geographic | Urban |
| Socio-Econ. Status | Middle Income |
| Race | African American |
| Religious Affiliation | Unique Religious Needs (Blood, Medicines) |

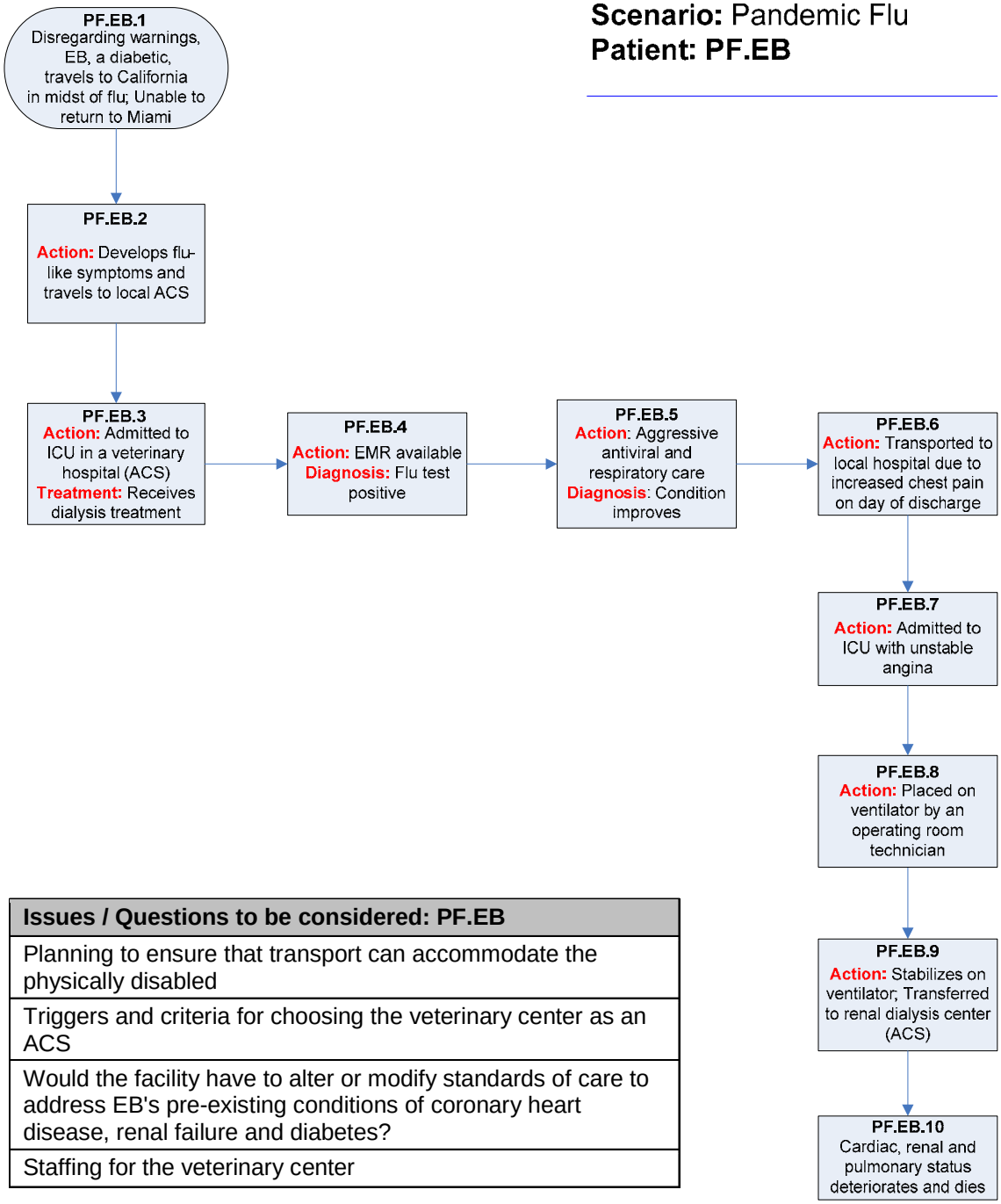
*See next page for clinical flow.*

## Use-Case # PF.EB (Pandemic Influenza)

EB, a 55-year-old wheelchair-bound diabetic, with heart disease and chronic renal failure, is spending Thanksgiving with his family in Miami. Disregarding the warnings of limited travel, EB decides to fly to San Francisco, California the next day. Within a week of arrival, EB finds himself in the midst of a huge outbreak of influenza. He is not allowed to travel back to Miami due to FAA regulations. Within a week, he becomes very ill and he goes to the local veterinary center, designated as an advanced ACS. He receives limited ICU care and continues his twice-a-week dialysis.

His records are available electronically to the staff from the Veteran Affairs / Department of Defense database, and a flu test confirms that he has the pandemic influenza strain. With aggressive antiviral and respiratory care, EB's condition improves. However, on the day he was to be discharged from the ACS, he begins having chest pain. He is transported to the local hospital for immediate admission to the ICU with a diagnosis of unstable angina and is eventually placed on a ventilator by an operating room technician. EB's condition improves and he is removed from the ventilator and is transferred to a renal dialysis center serving as an ACS for those patients with special medical needs. At the site, his cardiac, renal, and pulmonary status suddenly deteriorate and subsequently he dies.

**Scenario:** Pandemic Flu
**Patient: PF.EB**




| Issues / Questions to be considered: PF.EB |
|---|
| Planning to ensure that transport can accommodate the physically disabled |
| Triggers and criteria for choosing the veterinary center as an ACS |
| Would the facility have to alter or modify standards of care to address EB's pre-existing conditions of coronary heart disease, renal failure and diabetes? |
| Staffing for the veterinary center |

**Legend and Acronyms**:

| | | |
|---|---|---|
| TC: | Triage Center | ACS: Alternate Care Site |
| ICU: | Intensive Care Unit | EMR: Electronic Medical Records |
| - - - -: | Process step outside of healthcare system | |
| *Text*: | Event within the scenario that impacts the use case | |

Figure 18. Pandemic Flu: EB Clinical Flow

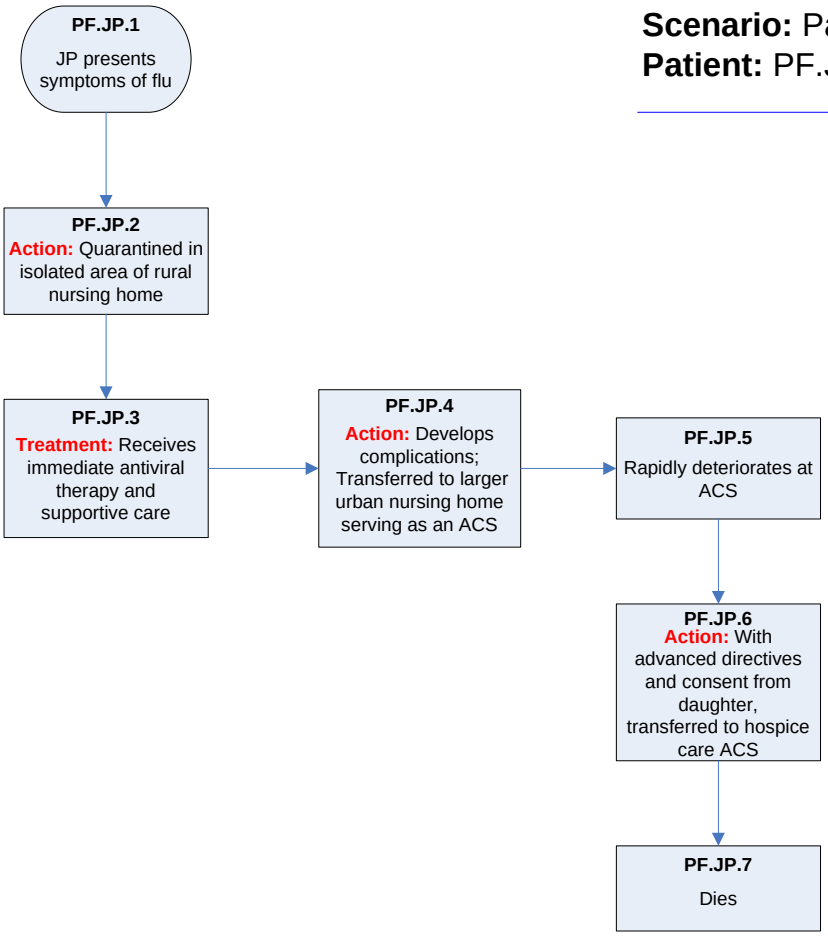
| Use-Case No. | 5 |
|---|---|
| Name | JP |
| Age | Frail Elderly (85 years) |
| Health Status | Alzheimer's (Nursing Home / Home Care) |
| Gender | Female |
| Marital Status | Single |
| Financing | Medicare |
| Language | English |
| Special Needs | Vision / Hearing Impaired |
| Legal Status | US Citizen |
| Geographic | Rural |
| Socio-Econ. Status | High Income (US Senator's mom - high visibility patient) |
| Race | Caucasian |
| Religious Affiliation | Protestant |

*See next page for clinical flow.*

## Use-Case # PF.JP (Pandemic Influenza)

JP, an 85-year-old frail elderly Alzheimer's patient lives in a skilled nursing home in a rural area north of Sacramento. She is also vision and hearing impaired. The Alzheimer's unit has been anticipating a pandemic influenza epidemic for years. This year, plans were implemented to allow the nursing home staff to screen for influenza through frequent lab testing and patient temperature monitoring. In early December, JP is one of several patients who contract influenza. She is moved to an isolation area of the facility for supportive care and antiviral therapy. JP's condition worsens and she is transported to a large urban nursing home, which has been designated as an ACS for those with advanced needs. JP's health rapidly deteriorates and pursuant to her advanced directives and agreement from conversations with her daughter, JP is moved to a hospital-based alternate care site where she dies.

**Scenario:** Pandemic Flu
**Patient:** PF.JP




| Issues / Questions to be considered: PF.JP |
|---|
| Availability of transportation to outlying rural areas |
| Will the facilities (existing or ACS) have the capability to provide JP with medications to address her pre-existing conditions? |
| What planning needs to occur to ensure that transport can accommodate patients with vision and hearing impairments? |

**Legend and Acronyms**:

| | | |
|---|---|---|
| TC: | Triage Center | ACS: Alternate Care Site |
| ICU: | Intensive Care Unit | EMR: Electronic Medical Records |
| - - - -: | Process step outside of healthcare system | |
| *Text*: | Event within the scenario that impacts the use case | |

Figure 19. Pandemic Flu: JP Clinical Flow

## Next Steps

CDHS' February 2006 California Hospital Surge Capacity Survey (CHSCS) to assess healthcare surge capacity among HRSA participants enabled identification of several issues affecting healthcare facilities and personnel during an emergency.

As a next step, Collaborative Design Sessions will be conducted for each of the three surge preparedness components (Surge Planning, Standards and Liability, and Reimbursement). The participants will analyze the fifteen use cases (three scenarios, five patients each) for the purpose of assessing the gaps in today's healthcare system, challenged by the scenarios, to surface specific issues that need resolution. The issues identified in the first CDS (Surge Planning) will be included in the subsequent CDS (Standards & Liability), and the combination of these issues into the third CDS (Reimbursement). The overall goal of the three sessions is to identify, assess, and prioritize as many surge-related issues as possible in an integrated fashion, in order to create a more effective system for surge.

The Sessions will not only enable refinement, augmentation and prioritization of the issues, but also formation of stakeholder workgroups that will ultimately be responsible for resolution of the issues.

# Appendix A: Scenarios and Consequential Attributes Cross Matrix

The matrix below shows seventeen scenarios rated on twelve consequential attributes. The six highlighted scenarios were identified as ones that would put varying degrees and complexity of stress on the healthcare system.

| Scenario | Type | Scope | Healthcare Impact | | | | Injury Type | Population Displacement | Lead Time | Recovery Time | Probability | Casualty Generation Ability | Ability to Generate "Worried Well" |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Facilities | Medical Personnel | Supply Chain | Injury Type | | | | | | | |
| 10-K Improvised Nuclear | LTC | Regional | Moderate | Moderate | Moderate | Trauma and Burn | Radiation-induced Illness | Widespread/Most Issues/Long Term | Short | Years | Low | High | High |
| Aerosol Anthrax | Moderate | Local | Minimal Impact/ Short Term | Moderate | Minimal Impact/ Short Term | Infectious Disease (non-Propagating) | — | Minimal Impact/Short Term | Short | Months | Low | Medium | High |
| Pandemic Influenza | STC/ LTC | Global | No Impact | Widespread/ Most Issues/ Long Term | Widespread/ Most Issues/ Long Term | Infectious Disease (Propagating) | — | Moderate | Medium | Months | Medium | High | High |
| Plague | Moderate | Local | No Impact | Widespread/ Most Issues/ Long Term | Minimal Impact/ Short Term | Infectious Disease (Propagating) | — | Minimal Impact/Short Term | Short | Weeks | Low | Medium | High |
| Blister Agent | Moderate | Local | Minimal Impact/ Short Term | Moderate | Minimal Impact/ Short Term | Chemical Poisoning and Botulinum | — | Minimal Impact/Short Term | Short | Days | Low | Low | High |
| Toxic Industrial Chemical | Moderate | Local | Minimal Impact/ Short Term | Minimal Impact/ Short Term | Minimal Impact/ Short Term | Chemical Poisoning and Botulinum | — | Minimal Impact/Short Term | Short | Days | Medium | Low | Medium |
| Nerve Agent | Moderate | Local | Minimal Impact/ Short Term | Minimal Impact/ Short Term | Minimal Impact/ Short Term | Chemical Poisoning and Botulinum | — | Minimal Impact/Short Term | Short | Days | Low | Medium | High |
| Chlorine Tank Explosion | Moderate | Local | Minimal Impact/ Short Term | Minimal Impact/ Short Term | Minimal Impact/ Short Term | Chemical Poisoning and Botulinum | — | Minimal Impact/Short Term | Short | Days | Medium | Low | Low |
| Earthquake | LTC | Regional | Widespread/ Most Issues/ Long Term | Widespread/ Most Issues/ Long Term | Widespread/ Most Issues/ Long Term | Trauma and Burn | Infectious Disease (Propagating) | Widespread/Most Issues/Long Term | Short | Years | Medium | High | Low |
| Major Hurricane/ Tsunami/ Typhoon/ Flood | LTC | Regional | Widespread/ Most Issues/ Long Term | Widespread/ Most Issues/ Long Term | Widespread/ Most Issues/ Long Term | Trauma and Burn | Infectious Disease (Propagating) | Widespread/Most Issues/Long Term | Short | Months | High | High | Medium |
| Radiological Dispersal Devices | LTC | Regional | Moderate | Moderate | Moderate | Radiation-induced Illness | Trauma and Burn | Moderate | Short | Years | Low | Medium | High |
| Bombing Using Improvised Explosive Devices | Moderate | Local | Minimal Impact/ Short Term | Minimal Impact/ Short Term | Minimal Impact/ Short Term | Trauma and Burn | — | Minimal Impact/Short Term | Short | Days | Medium | Low | Low |
| Flood Contamination | Moderate | Regional | No Impact | Moderate | Widespread/ Most Issues/ Long Term | Chemical Poisoning and Botulinum | — | Minimal Impact/Short Term | Short | Weeks | High | Medium | High |
| Foreign Animal Disease (Foot and Mouth Disease) | LTC | Statewide | No Impact | No Impact | Moderate | Chemical Poisoning and Botulinum | — | Minimal Impact/Short Term | Short | Months | Medium | Low | Medium |
| Heat Wave | STC | Statewide | No Impact | Minimal Impact/ Short Term | Minimal Impact/ Short Term | Trauma and Burn | — | Moderate | Short | Weeks | High | Medium | Medium |
| Wild/ Urban Fires | STC | Regional | Minimal Impact/ Short Term | Minimal Impact/ Short Term | Minimal Impact/ Short Term | Trauma and Burn | — | Moderate | Short | Weeks | High | Medium | Low |
| Electrical Power Failures | STC | Regional | Moderate | Minimal Impact/ Short Term | Moderate | Trauma and Burn | — | Moderate | Short | Days | Medium | Medium | Low |

# Appendix B: Patient Attributes Research Data

The summary below represents research mainly related to California for the identified patient attributes.

## 1. California Population Characteristics

In 2006 there were more than 37.1 million people in California[11]. Almost half of the State's population was Caucasian, a little more than one-third were Hispanics, and the remainder were Asian, African American, Native American, Hawaiian/ Pacific Islander, or two or more races. Between 2004 and 2005, the State's Caucasian population declined by more than half a million while the Hispanic population increased by more than a million.[12]

## 2. Health Status

- Heart disease and stroke are the number one and number three causes of death respectively, and a leading cause of disability, among Californians. Compared to the nation, California has slightly above average rates for coronary heart disease and stroke mortality.[13]
- In 2004, diabetes was the reported underlying cause of death for 72,815 residents of the United States and the sixth leading cause of death. In California, diabetes ranked seventh and was the underlying cause of 7,119 deaths.[14]
- Chronic kidney disease affects approximately 19 million adult Americans, and its incidence is increasing rapidly. Diabetes and hypertension are the underlying causes in most cases of chronic kidney disease. In California, chronic kidney disease and end stage renal disease continue to rise.[15]
- Asthma is one of the most common chronic diseases of childhood. In 2004, an estimated 4 million children under 18 years old had an asthma attack and many others had "hidden" or undiagnosed asthma.[16]
- About 98,000 mostly elderly Californians are cared for in more than 1,100 freestanding skilled nursing facilities at any given time. Demand will increase as California's age 65-and-over population is expected to grow by nearly 140 percent by 2030. The state's 85+ population will more than double by 2030 to more than one million residents.

Considering these health factors in a surge situation are vital as in an emergency these populations lose critical stability when they do not have access to medications medical equipment, caregivers and service animals. Subsequently, previously independent and self-sufficient disaster survivors become dependent upon the emergency response system.[17]

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[11] *California Current Population Survey Report*, California Dept. of Finance, March 2005
[12] *California Current Population Survey Report*, California Dept. of Finance, Demographic Research Unit, January 2006.
[13] *California Heart Disease and Prevention Program*, California Department of Health Services.
[14] *Diabetes Deaths in California, 2004,* Daniel H. Cox, California Department of Health Services, July 2006.
[15] *Healthy California 2010: Progress in Achieving the Healthy People 2010 Objectives, 2000-2005,* California Department of Health Services, September 2006.
[16] American Lung Association, August 2006.
[17] *California's Nursing Homes: A System in Trouble*, California Healthcare Foundation, July 2003.

## 3. Financing

Following hurricane Katrina, the cumbersome process of authorization for reimbursement for medical and public health services created delays and frustration among healthcare providers and the general public.[18] Addressing issues of insurance coverage, timely reimbursement to providers, and sustainability of the healthcare infrastructure following a surge situation is critical to successful development of a response plan.

In 2004, 6.7 million Californians (18.7 percent) of all ages were uninsured. Of the total state population, the percentage uninsured was highest among persons aged 18 to 64 years (24.4 percent) and lowest among persons aged 65 or more (1.6 percent). Men were more likely than women to lack health insurance coverage, 20.5 percent men compared with 16.9 percent women. Hispanics were more likely to have been uninsured than any other racial group (30.4 percent). Persons below the Federal Poverty Level (FPL) had a higher risk of being uninsured than those at or above the FPL.[19]

## 4. Language

Top 10 Languages: California 2000

| Language | Percent |
|---|---|
| English | 60.5% |
| Spanish | 25.8% |
| Chinese | 2.6% |
| Tagalog | 2.0% |
| Vietnamese | 1.3% |
| Korean | .9% |
| Armenian | .5% |
| Japanese | .5% |
| Persian | .5% |
| German | .5% |
| Other | 4.9% |

## 5. Special Needs

Census 2000 data showed that approximately 20.9 million American families had at least one member with a disability and that 19.3 percent of all Americans over the age of five years have a disability.[20] A report on the Special Needs Assessment for Katrina Evacuees (SNAKE) Project underscores that "although local, state, regional and Federal government agencies play major roles in disaster planning and response, traditional government response agencies are often ill equipped to meet the needs of disability and aging populations during emergencies."[21]

During Hurricane Katrina, one of the hardest hit communities was the deaf and hard of hearing. Over 80 percent of the shelters did not have access to TTY; 60 percent of the shelters did not have television capabilities; and less than 30 percent had access to sign language interpreters.

[18] A Summary of Four After-Action Reports on Hurricane Katrina, ASTHO, May 9, 2006.
[19] California Current Population Survey Report, California Department of Finance, March 2005.
[20] Disability and American Families 2000, U.S. Census Bureau, July 2005.
[21] Report on Special Needs Assessment for Katrina Evacuees (SNAKE) Project, National Organization on Disability, 2005.

## 6. Legal Status

There were an estimated 11.1 million unauthorized migrants in the United States in 2005. Based on analysis of other data sources that offer indications of the pace of growth in the foreign-born population, the Pew Hispanic Center developed an estimate of 11.5 to 12 million for the unauthorized population as of March 2006. The Center estimates that 2.5 to 2.75 million of these unauthorized migrants reside in California.[22] Additionally, there are approximately 3.3 million California legal permanent residents[23], and 8.1 million Foreign-born Californians[24]. For California, these are critical issues as they create an additional stressor on a healthcare delivery system already stretched during a surge scenario.

To put things in perspective, according to U.S. Citizenship and Immigration Services, more than 30,000 non-immigrants (temporary residents) other than tourists and almost 25,000 lawful permanent residents were affected by Katrina.

## 7. Geographic (Rural/ Urban)

California is a large and diverse state, with both urban and rural communities spread across the state. Rural issues, while as acute as those in urban areas, have very different characteristics. With only eight percent of California's population, rural areas comprise 94 percent of the land area. The California Rural Health Association indicates:

- 1,100,000 California residents live in rural areas of Southern California, 2,300,000 live in Central, and 1,500,000 live in Northern;[25]
- State population at the 1990 Census was 29,760,021. Population at the 2000 Census was 33,871,648. An increase of 4,111,627 or 12%;[26]
- The rural population at the 1990 Census was 3,232,000 and the 2000 Census reported 3,896,000 rural residents, an increase of 664,000 or 20%;[27]
- Of rural residents who have health insurance, approximately 60% is derived from employers;[28]
- Among the rural residents who have health insurance, the proportion of those with Medicare is greater in rural counties than in urban counties (18% vs. 16% respectively);
- There is a greater proportion of rural residents covered by Medi-Cal compared to urban residents (14% vs. 10% respectively);[29]
- Of the 6,500,000 residents of California who were beneficiaries of Medi-Cal services in fiscal year 2003-04 and 2004-05, 1,900,000, or 29% live in rural areas.[30]

In addition, providing transportation services to a sparsely and widely distributed population presents special transportation challenges, particularly in an emergency, which must be considered when planning for a balanced, interconnected system.[31]

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[22] Estimates of the Unauthorized Migrant Population for the State, The Pew Hispanic Center, April 2006.
[23] Dept of Homeland Security, Office of Immigration Statistics, Feb 2006
[24] Growth in the Foreign Born Workforce, California Immigrant Policy Center, Aug 2006
[25] 2000 Census data.
[26] Department of Finance 2005.
[27] Department of Finance 2005.
[28] Behavioral Risk Factors Survey 2004.
[29] Department of Health Services –Medical Care Statistics Section 2004.
[30] Department of Health Services –Medical Care Statistics Section 2004.
[31] California Transportation Plan 2025, California Department of Transportation.

## 8. Socio-Economic Status

Disaster vulnerability and poverty are mutually reinforcing. Factors such as low income, poor housing and public services, lack of social security and insurance coverage force the poor to behave in ways that expose them to greater risk. Generally, marginalized groups have less social power and fewer economic resources and physical capacity to anticipate, survive and recover.[32]

In California, the majority (51%) of persons 15 years and over reported incomes of less than $20,000 a year; only 10% reported incomes of $75,000 or more per year. In 2004, median income for California families was $55,000. Families with a Caucasian head of household had the highest median income ($69,898) while families with a Hispanic head of household had the lowest ($38,664). In 2005, over 4,800,000 Californians were living below the poverty level, representing 14% of the State's population. Of the 8,800,000 families in California, more than one in ten families (11%) reported living below the poverty level.[33]

## 9. Religious Affiliation

An individual's religious affiliation can impact their medical care choices as well as end of life decisions. According to the Association of Religious Data Archives, California had the following Religious affiliations in 2000:[34]

| Religious Affiliation | |
|---|---|
| Evangelical Protestant | 7% |
| Mainline Protestant | 4% |
| Catholic | 30% |
| Other (Buddhist, Muslim, Jewish, etc.) | 5% |
| Unclaimed | 54% |

[32] Socio-Economic Aspects of Water-Related Disaster Response, International Strategy for Disaster Reduction.
[33] California Current Population Survey Report, California Department of Finance, March 2005.
[34] http://www.thearda.com/mapsReports/reports/state/06_2000.asp.

# Glossary

| Term | Definition |
|---|---|
| **Alternate Care Site (ACS)** | Also known as Alternate Care Facility (ACF). An alternate healthcare operating location for use when the primary facilities are inaccessible. Includes traditional and non traditional care centers, for example outpatient facilities or nursing homes and home health care used in non traditional means or churches, or other non health facilities used for healthcare |
| **Antiviral** | A drug that is used to treat a disease caused by a virus, by interfering with the ability of the virus to multiply in number or spread from cell to cell. |
| **Categories of Disaster/ Incidents: Catastrophic** | Mass casualty incidents result in 10,000+ victims. Characterized by wide-ranging impact, it has statewide impact across regions. Such events may be either short-term (immediate impact, majority of casualties in minimal time, severe short-term impact on health system) or long-term (gradually increasing impact, exponentially increasing casualties, severe long-term impact on health system).. |
| **Categories of Disaster/ Incidents: Moderate** | Mass casualty incidents result in 250-10,000 victims. Characterized by broader impact, this situation would generally result in a mass casualty incident. It extends beyond local area to broader regional involvement. |
| **Decontamination** | The reduction or removal of contaminated material from a structure, object or person. |
| **Emergency** | A condition of disaster or of extreme peril to the safety of persons and property caused by such conditions as air pollution, fire, flood, hazardous material incident, storm, epidemic, riot, drought, sudden and severe energy shortage, plant or animal infestations or disease, the Governor's warning of an earthquake or volcanic prediction, or an earthquake or other conditions, other than conditions resulting from a labor controversy. |
| **Emergency Management** | Describes the science of managing complex systems and multidisciplinary personnel to address extreme events, across all hazards, and through the phases of mitigation, preparedness, response, and recovery. |
| **Epicenter** | The point on the earth's surface vertically above the hypocenter (or focus), point in the crust where a seismic rupture begins. |
| **Fallout Path** | The path marked by minute particles of radioactive debris in the atmosphere following a nuclear explosion. |
| **Fault Zone** | The fracture along which the blocks of crust in the Earth on either side have moved relative to one another parallel to the fracture. |
| **Hazard** | A force or agent with the ability to cause adverse human physical or psychological effects (injury, death) and / or significant economic damage. |

| Term | Definition |
|---|---|
| **HRSA** | Health Resources and Services Administration: An agency of the U.S. Department of Health and Human Services. HRSA primary Federal agency for improving access to healthcare services for people who are uninsured, isolated or medically vulnerable. |
| **Isolation** | Separation during period of communicability of a patient with a disease from others who may be susceptible. |
| **Pandemic Flu** | A virulent human flu that causes a global outbreak, or occurring over a wide geographic area and affecting an exceptionally high proportion of the population. |
| **Preparedness** | The range of deliberate, critical tasks and activities necessary to build, sustain, and improve the capability to protect against, respond to, and recover from hazard impacts. Preparedness is a continuous process. |
| **Prevention** | Activities to provide outright avoidance of the adverse impact of hazards and means to minimize related environmental, technological and biological disasters. |
| **Prophylaxis** | A medication or a treatment designed and used to prevent a disease from occurring |
| **Public Awareness** | The processes of informing the general population, increasing levels of consciousness about risks and how people can act to reduce their exposure to hazards. This is particularly important for public officials in fulfilling their responsibilities to save lives and property in the event of a disaster. |
| **Quarantine** | Restricting the activities of apparently healthy people who have been or suspected to have been in contact with a patient with communicable disease. |
| **Recovery** | The phase beyond response that addresses physical and financial restoration of the impacted population and area, including developing and implementing strategic plans for full restoration, improvement and growth. |
| **Risk** | The probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human induced hazards and vulnerable conditions. |
| **Scenario** | An event that impacts a large enough population to push the healthcare system into a surge mode (scenario and incident used interchangeably). |
| **Second Wave** | A second wave refers to a second spread of an epidemic from person to person transmission. |
| **Soil Liquefaction** | A process by which water-saturated sediment temporarily loses strength and acts as a fluid, like when you wiggle your toes in the wet sand near the water at the beach. This effect can be caused by earthquake shaking. |

| Term | Definition |
|---|---|
| **Strain** | A group of organisms within a species or variety. |
| **Surge** | Describes the ability to provide adequate medical evaluation and care in events that severely challenge or exceed the normal medical infrastructure of an affected community (through numbers or types of patients). |
| **Surge Capacity** | The ability to evaluate and care for a markedly increased volume of patients - one that challenges or exceeds normal operating capacity. |
| **Surveillance** | The ongoing, systematic use of routinely collected health data to guide public health action in a timely fashion. |
| **Sustainable Development** | Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable development is based on socio-cultural development, political stability and decorum, economic growth and ecosystem protection, which all relate to disaster risk reduction. |
| **Use Case** | A patient's experience during a scenario as they move through the healthcare system in surge mode. |
| **Vendor-Managed Inventory** | A means of optimizing Supply Chain performance in which the manufacturer is responsible for maintaining the distributors inventory levels. |
| **Vulnerability** | A set of conditions and processes resulting from physical, social, economic, and environmental factors, which increase the susceptibility of a community to the impact of hazards. |
| **Worried Well (Potentially Exposed / Injured)** | Individuals that seek medical treatment who may not have a physical injury related to the incident. (It was acknowledged that the term "worried well" is not an ideal psychiatric term, however this term is commonly used among many health professionals and the general population). |

# References

[A] California Disaster Medical Response Plan; developed by California Emergency Medical Services Authority (Draft: October 17, 2006).

[B] Adapted from: Academic Emergency Medicine Journal (AEMJ) article; Hospital Disaster Preparedness in Los Angeles County by Amy H. Kaji, MD, MPH and Roger J. Lewis, MD, PhD.

[C] Adapted from: Center for Disease Control (CDC) article; Influenza Pandemic Preparedness by Kathleen F. Gensheimer, Martin I. Meltzer, Alicia S. Postema, and Raymond A. Strikas.

[D] Adapted from: National Planning Scenarios, created for Use in National, Federal, State, and Local Homeland Security Preparedness Activities (April 2005) by The Federal Interagency – coordinated by the Homeland Security Council (HSC) and in partnership with the Department of Homeland Security (DHS).

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[E] Adapted from: National Planning Scenarios, created for Use in National, Federal, State, and Local Homeland Security Preparedness Activities (April 2005) by The Federal Interagency – coordinated by the Homeland Security Council (HSC) and in partnership with the Department of Homeland Security (DHS).

[F] Adapted from: Center for Disease Control (CDC) article; Influenza Pandemic Preparedness by Kathleen F. Gensheimer, Martin I. Meltzer, Alicia S. Postema, and Raymond A. Strikas

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