Chapter 1

Introduction: Globalization Creates Potential for Outbreaks of Infectious Diseases

It's 10 a.m. A handful of patients are presenting with fever, cough, sore throat, and muscle aches to your hospital's emergency department (ED) in mid-summer, months away from the start of the influenza season. A few are presenting with eye infections.

It's 2 p.m. The ED is now overflowing with patients presenting with typical flu-like symptoms. A handful of patients in acute respiratory distress are arriving by ambulance. The emergency medical technician says that this is the sixth case and third hospital he has taken such a patient to today.

It's 7 p.m. Half of the ED patients begin experiencing what appears to be primary viral pneumonia and multi-organ failure. They are transferred to the intensive care unit (ICU) to receive mechanical ventilation. Meanwhile, patients have overflowed from the ED into the hallways as they await a diagnosis and treatment.

It's 10 p.m. All of the nearby hospitals are reporting an influx of patients with flu-like symptoms. Their EDs are overcrowded, every inpatient bed is filled, and the night shift—already sparse—is short-staffed because some health care workers (HCWs) are afraid to come to work due to the mysterious infectious outbreak being reported on the local television news.

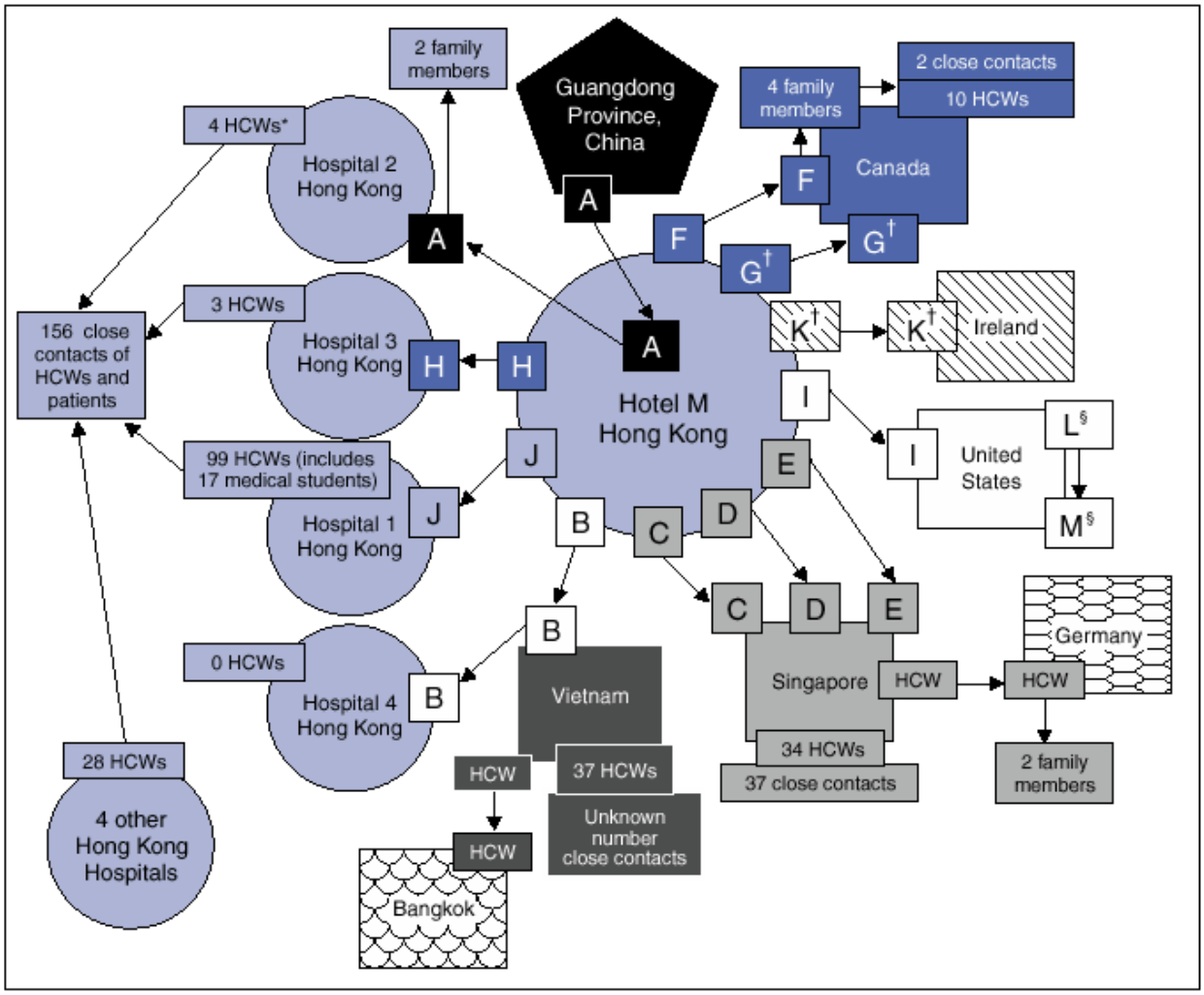
NATURAL OCCURRING AND DELIBERATE OUTBREAKS

The aforementioned scenario is not a far stretch of the imagination. Globalization, in part, has created the potential for this kind of real-life drama of an infectious disease outbreak to unfold at any hospital in any part of the country, and such outbreaks are not merely fictional accounts.

There are several examples of naturally occurring outbreaks. One prime case is the 2002 severe acute respiratory distress syndrome (SARS) outbreak, which started with the first occurrence of an atypical pneumonia reported in the Guangdong province of China in November 2002. In February of the following year, a 65-year-old physician who treated patients with atypical pneumonia in Guangdong traveled to Hong Kong to attend a wedding. It was there that the atypical pneumonia, later given the name SARS, was transmitted to other guests (Figure 1). Between November 2002 and July 2003, 8,096 cases of SARS, resulting in 774 deaths in 30 countries, were reported to the World Health Organization (WHO). During that time, 1,706 HCWs experienced symptomatic infections. Approximately 20% of the patients in Singapore and Toronto required mechanical ventilation. By the 8^{th} week of infection in Toronto, only 61% of those patients remained alive. By the 13^{th} week of infection in Singapore, only 48% of patients remained alive.

A second example is the case of imported Lassa Fever in the United States. A 38-year-old New Jersey businessman, originally from Liberia, died in August 2004 after returning from a trip to West Africa. He came in contact with 188 people in 3 continents during the time period he was likely infectious.

FIGURE 1. Chain of transmission among guests at Hotel M — Hong Kong, 2003



* Health-care workers.
† All guests except G and K stayed on the 9th floor of the hotel. Guest G stayed on the 14th floor, and Guest K stayed on the 11th floor.
§ Guests L and M (spouses) were not at Hotel M during the same time as index Guest A but were at the hotel during the same times as Guests G, H, and I, who were ill during this period.

Figure 1. Source: MMWR 52(12):241-248 at

http://www.cdc.gov/MMWR/preview/mmwrhtml/mm5212a1.htm

In 2003, an epizootic of the avian influenza A occurred among birds in certain areas of Asia, parts of Europe, the Near East, and Africa. That same year, 3 human deaths

were attributed to this influenza virus that typically does not infect people. By June 2006, outbreaks among poultry and wild birds were ongoing in 10 countries, according to the Centers for Disease Control and Prevention (CDC). Meanwhile, 309 cases of human H5N1 virus infection have been reported, resulting in 187 deaths, through May 31, 2007. Most of these cases have occurred from direct or close contact with infected poultry or contaminated surfaces. Although there is no evidence to suggest that transmission resulted from person-to-person contact, the ability of all influenza viruses to mutate has scientists concerned that the H5N1 virus could one day be able to infect humans and spread easily from one to another.

In addition to naturally occurring or emerging infectious diseases such as these, there is the threat of outbreak from the intentional release of biological agents. In 1984, the Bhagwan Shree Rajneesh cult contaminated salad bars in 10 restaurants in Oregon, resulting in 751 people developing Salmonella gastroenteritis. The first documented case of a bioterrorism attack involving an aerosolized form of *Bacillus anthracis* occurred in 1993 when the Aum Shinrikyo cult released the agent off the roof of an eight-story building in Tokyo, Japan. Cult members were hoping to cause an inhalational anthrax epidemic. Two years later, they released sarin gas in the Tokyo subway killing 12 people and injuring more than 5,000. More recently, 22 cases of anthrax were reported in the United States in 2001 when *B anthracis* was deliberately spread via the postal system. Half of the cases were inhalational and half were cutaneous. Five of the inhalational cases resulted in death.

Both naturally occurring and deliberate outbreaks from exposure to serious pathogens may result in an influx of critically ill and injured victims. The ability to rapidly delineate the diagnosis and treatment of these patients may have a significant impact on their outcomes. When evacuation is not possible, prolonged

medical management of a large number of patients may be necessary. This has the potential to rapidly overwhelm critical care capacity.

The diagnosis, treatment, and medical management of these patients will fall largely to critical care providers supplemented by hospital-experienced HCWs, the latter of whom will need to be cross-trained in providing such intensive care in a mass casualty event, as much of the necessary critical care will be provided outside the ICU in outbreak situations.

CRITICAL CARE PATIENTS WILL REQUIRE INTENSIVE CARE UNIT STAY

The first ICU in this country was a 3-bed neurosurgical post-operative unit established in 1923 at Johns Hopkins Hospital in Baltimore. Four years later, the first premature-born infant care center was established at Sarah Morris Hospital in Chicago. During World War II, the ICU concept became mainstream when isolated rooms in the hospital, known as shock wards, were established to resuscitate and care for solders injured in battle or undergoing surgery. The advent of mechanical ventilation in the 1950s led to the rapid expansion of respiratory ICUs. In 2001, the total number of "adult" ICU beds was 66,199 and the total number of "pediatric" ICU beds was 20,610. Today, the United States has approximately 6,000 ICUs in which 55,000 critically ill patients are cared for daily.

Basically, there are two types of patients being treated in the ICU: those with an immediate need for interventions for whom the risk of death or serious morbidity is high and those who require intensive monitoring to evaluate the need for potential interventions. The former would receive priority attention during a disaster.

The major components of critical care medicine are as follows:

- Supportive interventions for failing organs
- Disease-specific therapies
- Advanced patient monitoring
- Minimization of adverse consequences

The complexity of critical care medicine continues to grow as a result of medical and technological breakthroughs. It entails a broad range of interventions and high-level care functions. Due to the complex nature of the care provided to critically ill or injured patients, clinicians who provide such care require critical care-specialized training. The critical care team consists of a diverse group of highly trained professionals, including respiratory care professionals, pharmacists, nurses, physician assistants (PAs), nurse practitioners (NPs), primary care physicians, and physician specialists. The multidisciplinary team approach, often lead by an intensivist* has been shown to improve outcomes.

Even under the best circumstances, however, critical care outcomes are tenuous. For example, the usual ICU survival rate for the clinical condition of adult respiratory distress syndrome is between 40% and 65%; for severe sepsis, 73%; and for septic shock, 50%. In a mass casualty event, patients unable to receive mechanical ventilation and/or hemodynamic support are likely to die **(Table 1).**

Table 1: Critical Care Outcomes

Clinical Condition	Usual ICU Survival	Disaster Situation

* Intensivists are physicians who have been trained and certified in a primary specialty, typically internal medicine, surgery, pediatrics, or anesthesiology. After completing a residency, they receive an additional 1 to 3 years of specialty training in critical care medicine, after which they become board eligible.

ARDS	40-65%	Patients unable to receive mechanical
Severe Sepsis	73%	ventilation and/or hemodynamic
Septic Shock	50%	support are likely to die

An increase in patient demand for critical care services caused by the aging population and advances in medicine that extend life expectancy coupled with a shortage of ICU beds and staff across the country currently complicates the provision of critical care. ICU occupancy is high, ranging from 65% to 80%. Also, more than 10% of ICU beds are closed due to the current nursing shortage, which has hit the specialty areas especially hard. Additionally, a shortage of clinical pharmacists and respiratory therapists exists. There is an expected shortfall of intensivist* hours equal to 35% of the demand by 2020, despite the fact that there has been a recent increase in trainees entering the critical care subspecialty.

THIS COURSE

The reality is that most hospitals have an insufficient number of critical care-specialized staff to provide mass casualty critical care. That means hospital-experienced HCWs, including non-critical care trained pharmacists, respiratory care professionals, nurses, NPs, PAs, and physicians will most likely have inpatient responsibilities during a mass casualty event. This course, Hospital Mass Casualty Disaster Management, was developed to offer the critical care "cross-training" knowledge and skills necessary to provide appropriate patient care during a disaster, in which the number of critically ill and injured patients will far exceed local ICU capacity and overwhelm inpatient hospital capacity. Training will focus on the provision of critical care in unconventional hospital locations with limited resources.

The overall course objectives are as follows:

1) Recognize that mass casualty events will overwhelm hospital inpatient capacity by generating a large number of critically ill and injured victims.
2) Recognize that planning and preparing for inpatient surge capacity should include "critical care cross-training" of HCWs as a method to counter shortages of appropriately skilled and trained critical care staff.
3) Recognize the major functional components of traditional critical care management.
4) Discuss key components of emergency mass critical care.
5) Discuss the management of patients requiring mechanical ventilation or hemodynamic resuscitation that is relevant to one's roles and responsibilities during emergency mass critical care.
6) Demonstrate the ability to correctly set-up and operate the mechanical ventilators maintained by the CDC's Strategic National Stockpile program.
7) Demonstrate the correct use of select personal protective equipment and recognize the levels of protection necessary for given situations.

This course is insufficient to make participants competent at independently practicing critical care. Rather, it is customized to be a comprehensive discussion of those global and specific concerns, information, and skills necessary to address an infectious disease outbreak or other disaster that may be encountered in professional practice. Participants are strongly encouraged to collaborate with critical care specialists from their respective disciplines to care for critically ill and injured disaster victims.

