

# Humanity amid conflict, terror and catastrophe: hypothetical but possible scenarios

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## **Abstract**

*This article offers an understanding of the nature, scale and complexity of two hypothetical yet possible events and their potentially overwhelming impact upon health, security and socioeconomic productivity. It describes a no-warning CBRNE incident and a gradual rising-tide emergency with a newly emerging infectious disease, summarizing a range of likely response actions, impacts and constraints, particularly for the humanitarian community.*

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Over the past decade conflict-generated emergencies and armed confrontations have caused a huge death toll and considerable human suffering and displacement worldwide. Hundreds of thousands of people are affected by violent conflict and militant activity, to which United Nations and non-governmental organizations provide life-saving humanitarian services, often in difficult and dangerous circumstances with limited humanitarian space. In recent years, terrorism has become a stark reality for many of the world's civilians caught up in armed conflict situations where both crude and new weapons of terror are being used. The first fictitious worst-case scenario depicts detonation of "dirty bombs" in a highly populated city in a developing country, entrenched in conflict, strife and terrorist

activity. It aims to give a glimpse of the pandemonium and chaos that could ensue, and the security constraints and restrictions that aid organizations are likely to face.<sup>1</sup>

The humanitarian community is also at times faced with catastrophic public health emergencies and the increased risk of global spread – that is, across national boundaries.<sup>2</sup> The second hypothetical scenario portrays the possible mutation of avian flu into a virulent human virus and a newly emerging “high hazard pathogen” which would cause a pandemic with global catastrophic impact on all sectors of society over a protracted period. Some of the possible health effects and social impact are elaborated to raise awareness of the need for contingency planning and preparedness, especially among health and humanitarian sectors.

It should be noted, however, that these scenarios are illustrative and speculative only – although intended to be realistic. The likelihood and impact of their occurrence has been based on open reporting and conjecture, and should not be construed to reflect, or necessarily be supported by intelligence reporting, threat or risk assessment. Moreover, all outcome figures and the likely impact of the hazards described are estimates and have not been modelled mathematically or scientifically, but they should give the reader an indication of possible dimensions involved in these plausible worst-case scenarios.

## **Armed conflict scenario with deliberate chemical and radiological release**

### **Chronology of events**

As on most mornings the deafening sound of artillery fire and explosions echoes across the capital. A bomb-laden chlorine tanker crashes into an ammonia storage unit, causing a massive explosion, propelling columns of smoke and flames into the air. Firefighters try to contain the hazard but are hampered as a black plume unleashes toxic gas, killing tens of workers inhaling the poisonous fumes. People are overcome with breathing difficulties, and more than 100 civilians are hospitalized, complaining of chest pains and burning sensation of eyes and skin.

Minutes later, simultaneous bombs with a ball-bearing packed charge detonate in another city, targeting the college campus and local bazaars – creating a giant fireball with flames instantly swallowing up bystanders and leaving a mass of charred, lifeless bodies and wounded people strewn everywhere. Then, as a gathering of thousands of pilgrims begin an annual ritual and procession, another

1 See also Anthea Sanyasi, “Extreme Emergencies: humanitarian assistance to civilian populations in middle and low income countries following chemical, biological, radiological and nuclear incidents”, Intermediate Technology Development Group, United Kingdom, 2004.

2 See “Global crises, global solutions”, available at [www.who.int/csr/resources/publications](http://www.who.int/csr/resources/publications) (last visited 25 June 2007).

enormous explosion shakes the foundations of a holy site, collapsing its structures and leaving a crater in the ground. Fires erupt everywhere, with huge billows of acrid smoke drifting across the skyline as black clouds turn daylight to thick fog. Eyewitnesses report seeing hundreds of people blown to bits by the blast, with blood-splattered body parts hurled over wide areas and injured people lying among them. Survivors tell how they tried to pull casualties from the rubble and carnage, some people still ablaze and entangled in burning wreckage.

Amid all the terror and chaos, electronic devices on foreign military patrols alarm detecting radiation isotopes, and soldiers can be seen hurriedly donning gas masks. Security is tightened as the police take control and set up a cordon, diverting traffic and causing a massive gridlock. Adding to the tension, military police fire rounds into the air, stopping and searching motorists at random, and demanding to see identity papers. Smoke bombs attempting to screen security cars provide futile protection against tertiary detonation of new armour-piercing roadside bombs.

### *Immediate response*

Fire and rescue brigades try to douse sporadic fires and search for survivors trapped amongst smouldering debris. A body holding area is cordoned off while police collect shredded parts for forensic examination. Emergency service sirens scream incessantly as ambulances and paramedics arrive but then quickly retreat in search of protective clothing and masks. In desperation, some survivors in the blast area commandeer pick-up trucks and wooden carts to transport badly injured people to hospital. Specially equipped military medics are mobilized to triage casualties at the scene, prioritizing only those most likely to survive. The few hospitals functioning in the city soon become overwhelmed with hoards of self-presenters and bomb casualties strewn on floors and corridors, excluding any possibility of precautionary decontamination or lockdown.

### *Panic and pandemonium*

Interpreters serving with foreign forces leak information to the local population about the detonation of a “dirty bomb” with a radiological dispersal device. As rumours abound, the fear of radiation from fallout reverberates, and pandemonium breaks out as the crowd attempts to escape the disaster zone. People are seen running in all directions, trying to cover their nose and mouth, although there is nothing to see or smell except for smoke and smouldering debris. Police command units give orders to the crowd not to touch anything and to shelter outside the extended cordon. This triggers a huge stampede as people surge ahead and some less able are trampled and left injured on the ground. Most of the nearby buildings are already war-damaged and the barred windows provide little protection from drifting particles. Tourist hotels and bars are told to turn off all air-conditioning, fans and vents. Stall vendors try to cover their wares and shops pull down shutters as looters rampage.

### *Public warning and informing*

Police cars with loudhailers instruct everyone to find safe shelter and wash themselves in case of contamination, although daily water restrictions and shortages leave only enough for drinking. Panic-stricken people try to get news on radio and television but transmission is poor. As warning sirens alert surrounding communities of a catastrophic incident, children inadvertently let out of school find their homes out of bounds and Red Crescent volunteers start to trace families.

### *Deadly threats*

As the shock value of the deadly attack reaches its intended targets, security authorities are put on maximum alert. It becomes apparent that the radiological dispersal device had been detonated with the intent of instilling in the population fear of a lingering exposure risk.

Information leaks out that the bomb contained a highly radioactive source and that intelligence has received warning threats of more remotely controlled “dirty bombs” with increasingly lethal content, planted in other cities throughout the country. The breaking news and horrific scenes shock the rest of the world, and international scientists speculate that if sophisticated high-grade radiological materials were to be used, there could be mass fatalities and fallout contamination remaining for some time to come.

Taking the threat seriously and preparing for the worst, security services scale up and troops are put on standby. Not knowing where “dirty bombs” might go off next, blast barriers are placed at all strategic buildings and checkpoints in the capital.

### *Contingency plans?*

In the midst of all this chaos, a stream of mortars hit the main hospital, causing severe damage and more casualties. Questions are asked about viable contingency plans, and the authorities wonder how they would evacuate the most vulnerable population area, containing thousands of people, and the main hospital, overflowing with casualties. How would transport arrangements on such magnitude of scale be possible when the city is already suffering its worst fuel crisis ever?

With the exodus of medical personnel and most international humanitarian organizations and the spate of attacks on civilians, only a sparse number of aid agencies remain. The ongoing violent conflict, curfews, armed checkpoints and new restriction zones present huge security constraints for the humanitarian community in gaining access to the affected population.

### *Major incident management*

Analyzing the different aspects of the events, the management of such a scenario would have to address multiple problems of which the most important ones are outlined briefly.

### *Emergency response to a chemical hazard*

“Chlorine bombs” in the form of chlorine storage tanks and gas canisters are now being used as terrorist weapons.<sup>3</sup> This is not an entirely new hazard threat, since the deliberate release of chlorine occurred also in the First World War and has been used in recent bomb attacks in Iraq. If released into the atmosphere, chlorine liquid would evaporate to a volatile gas. It would disperse quickly, especially if the weather was warm and there was an appreciable wind. When combined with nitric acid or ammonia gas, high concentrations of chlorine in high temperatures would produce a very unstable explosive compound and “toxic gas”, requiring gas-tight chemical protective suits and breathing apparatus by emergency services. A dynamic risk assessment might detect the presence of secondary devices and other potentially hazardous substances from the explosion. Given that there was access to appropriate equipment, chemical experts would be able to conduct air tests from the smoke plume, and monitor air quality and quantity of material on site and its concentration and form if the cloud had not already dispersed.

### *Chlorine health effects*

The level of exposure of the general public would be dependant on the size and concentration of the chlorine gas release in the air, and the wind direction and speed, as well as the distance from the immediate hazard zone. The fumes would cause some fatalities within minutes and casualties with breathing difficulties, and skin and eye irritation, necessitating clinical decontamination. A feeling of suffocation, chest pain and tightness, abdominal pain, nausea, headache and dizziness would occur immediately following substantial exposure to fumes, although people would generally make a complete recovery.<sup>4</sup> Nevertheless, a threat of further chemical bomb attacks would probably increase a widespread fear of exposure to even more lethal substances.

### *The radiological dispersal hazard*

There is also a real risk that terrorists may acquire and develop radiological materials<sup>5</sup> that can cause casualties,<sup>6</sup> widespread fear and chaos. A radiological dispersal device is a radioactive source combined with conventional explosives, which could be in the form of a *crude* weapon with low yields. The detonation of a dirty bomb could cause a volatile gas and radioactive particles to be expelled into

3 Sharon Benn, “Chlorine cache found in Iraq”, available at [www.washingtontimes.com](http://www.washingtontimes.com) (last visited 23 March 2007). See also Peter Brookes, “Terror formula intensifies”, available at [www.military.com](http://www.military.com) (last visited 1 March 2007).

4 See [www.hpa.org/chemicals&poisons/chlorine](http://www.hpa.org/chemicals&poisons/chlorine) (last visited 15 April 2007).

5 See “Dirty bomb seizures rise”, *The Times* and *Sky News*, 6 October 2006. Armed Forces Radiobiology Research Institute (AFRRI), Medical Guidelines: Evacuation, Sheltering, and other Public Health Measures.

6 Immediate or chronic, realized or perceived casualties.

the atmosphere, borne away by a breeze and dispersed rapidly downwind, becoming diluted with distance.

Fallout radiation would contain *beta particles* which can travel short distances in tissue if large quantities are involved. Main fallout risk would be shortly after detonation around “ground zero” and would continue to emit for one to two days from a cloud containing radioactive materials, depending on wind and weather conditions. Some 800 sq m or even up to 15 km above the relocation threshold could become contaminated by radioactive dust. However, it is likely that a plume-modelling resource to understand the movement of radiological material in the urban environment would be available only within a military domain, if at all.

The risk to first-emergency responders who might have been exposed to higher radiation doses at the explosion scene would depend on the length of time spent in the hazardous area and their distance from the source. Radiation detectors would be able to locate external radioactive material at great distances, but would incident responders in a developing country have such equipment to hand?

### *Incident management and personal protective equipment*

Hazardous materials contingency plans might outline how, within minutes of a catastrophic incident, frontline emergency responders such as fire and rescue services and police tackle the immediate hazardous zone. Only first-responders with appropriate personal protective equipment would be allowed to work within the inner protective cordon around the immediate hazard zone. Self-contained breathing apparatus might be required by firefighters to put out vehicle fires, which produce dangerous chemical fumes.

Western military forces would be expected to don respiratory masks immediately, but having these to hand would depend on the perceived CBRNE threat, as briefed by intelligence. Moreover, military forces are likely to intervene in a major incident only if radiation dose rates are significantly high, since force protection would be their primary objective.

Other emergency services would use a lower level of personal protective equipment, although it is unlikely that all local responders, least of all ordinary citizens, would have easy access to chemical protective coveralls and butyl gloves.

Although radioactive contamination risk is assumed to be low, for those without appropriate protective equipment, specialist knowledge or training, an unknown lethal hazard would probably instil immense fear among responders and the “worried well”.

### *Civilian protection*

A communications strategy and procedure would be required to warn and inform civilians and ensure human safety and security. Advice would generally be “to go

inside, close all air conditioning and vents, tune into the local radio and await further instructions". Sheltering in-place would be the likely protective measure for people within a few kilometres' radius of a radiological incident site, but if expected to be longer than two days or radiation doses were found to be high, the evacuation option should be considered.<sup>7</sup> Some people might spontaneously evacuate and reside with host families. Others would need temporary safe shelters, survival relief items and clean water for emergency decontamination and drinking. Civil contingency planning would also need to consider possible full or partial evacuation of hospitals, residential centres and closed institutions such as prisons situated within the affected area.

### *Radiation exposure and health effects*

The explosive component of a radiological dispersal device would kill bystanders in the immediate vicinity by blast and shrapnel, with possibly 20 per cent direct blast fatalities. There would be about 70 per cent minor injuries from the explosion and inhalation of radioactive material from dust and smoke.<sup>8</sup> Conventional injuries would probably exceed those caused by a short-term external irradiation and inhalation hazard from the smoke plume, which might last locally for one minute or for over an hour if a fire ensued. Some casualties could have thermal-like burns but there might be few burns units in close vicinity of a blast area. Moreover, hospitals might lack medical staff, knowledge, treatment protocols and training to deal with radiation injuries.

External contamination would be in the form of deposits of dispersed radioactive material, such as dust on the skin, which can be washed off with a bucket of water and a sponge, and removal of outer clothing would generally reduce contamination by some 80 per cent. Only gamma emitters would present any immediate risk in wound contamination, but health professionals would need to be informed of the type of radiological risk.

It can take hours of exposure to accumulate enough radiation from a dirty bomb to cause radiation sickness, as particles are easily shielded. Potassium iodide tablets would be ineffective, since radioactive iodine is unlikely to have been used in a dirty bomb.

### *Psychological impact*

Probably the most important effect would be the psychological impact of a radiation dispersal hazard, which could instil shock, intense anxiety, grief and fear

7 AFRRRI Medical Guidelines: Evacuation, Sheltering, and other Public Health Measures to reduce/avert radiation dose, 25 February 2003, p.10, available at <http://www.aapm.org/meetings/05AM/pdf/18-2637-79236-706.pdf>.

8 AFRRRI Guidelines on dealing with deceased persons following radiological terrorism, 25 February 2003, p.30, available at [http://www1.va.gov/emshg/docs/Radiologic\\_Medical\\_Countermeasures\\_051403.pdf](http://www1.va.gov/emshg/docs/Radiologic_Medical_Countermeasures_051403.pdf) (last visited 25 June 2007).

of a longer-term health risk. People caught up in the disaster zone may complain initially of nausea, muscle tremors, dizziness, hyperventilation, psychosomatic symptoms, and later fatigue caused by anxiety, requiring supportive treatment. Acute anxiety could also induce psychogenic vomiting and other stress-related symptoms in both survivors and helpers. Uncertainty and lack of information would add to the fear of, and preoccupation with, the threat causing chronic conditions with carcinogenic effects. Moreover, psychosomatic symptoms caused by severe anxiety could have an overwhelming impact on scarce medical healthcare facilities.

### *Emergency triage and medical treatment*

Given the stringent security restrictions in most armed conflict situations, triage protocols and emergency care at the scene would probably be limited. Nowadays, in CBRN mass casualty planning in Western countries, reverse triage would be used on the basis of “the best for the most” needing emergency first aid. This means that those who can be saved are treated first, whereas the most severely injured and expected to die would have lower priority. This procedure would be counter-intuitive to most medical and clinical staff, and would need to be planned and trained for.

Clinically guided resuscitation and treatment of life-threatening injuries would always take precedence over measures to address radioactive contamination or exposure. As a casualty would not present an acute radiological contamination hazard to medical personnel and healthcare staff, life- or limb-saving medical or surgical treatment should not be delayed.

If mass decontamination at the incident scene were possible, it should be carried out at least fifty yards downwind from the treatment area, but delayed evacuation of casualties to medical facilities could also have health consequences.

### *Radiation monitoring and decontamination*

Generally a radiological dispersal incident is unlikely to be very harmful to caregivers within the local community, but they would clearly need to be convinced of this. Radiation monitoring equipment, if available, would be used by hospital staff wearing standard barrier clothing and surgical face masks to detect internal exposure (dose rates) or external contamination (particles of materials) on the body.

A clinical decontamination area, segregated and operated by gender, could be made as part of the medical treatment facility. Medical and clinical staff would also need to decontaminate themselves after the treatment and decontamination of patients.



### *Hospital care*

With the likelihood of regular attacks, rapid provision of emergency drugs and equipment to support the Ministry of Health would be needed. ICRC and other humanitarian organizations already provide medical and surgical teams and supplies to hospitals in most large cities affected by armed conflict to help with the major influxes of casualties, but already overstretched hospitals might lack sufficient supplies of intravenous (IV) fluids, blood banks and oxygen. Another healthcare consideration following bomb explosions is that disabled blast victims could increase the existing demand for orthopaedic devices and physiotherapy.

Recurrent shortages and disruption of fuel, gas and power would necessitate provision of additional generators for hospitals and health clinics. Lack of electricity supply would have a life-threatening impact, too, on specialist and intensive-care equipment in hospitals and refrigeration of mortuaries. Communication channels for vital public health information on the hazard and protective measures could also be affected.

### *Longer-term health consequences*

The long-term health risk would stem mainly from inhaling loose radioactive dust, and consequences would include possible reduced life expectancy, latent cancer risk and decreased fertility. Another possible risk is death from radiation injury infections during the phase of manifest illness as the immune response becomes depressed, increasing infectivity and virulence of diseases.

Where public health protection measures are possible, individuals in the affected area should be placed on a clinical register so that long-term surveillance and monitoring for health effects can take place. This might be difficult in a country ridden with widespread conflict, where revealing one's identity to the authorities could mean imminent death. Casualties and survivors may also include perpetrators and militants. Furthermore, given increasing security constraints, international medical relief organizations might have difficulty in gaining access to support monitoring of health effects and psychological trauma.

### *Body handling issues*

Normally, bodies or body parts should not be moved by rescue workers except to shield them from fire, as it would be necessary to preserve evidence at the disaster scene – though this may not always be the case in some conflict zones. In radiological incidents, the dose rate from contamination might prevent recovery of bodies by the police until protective shielding can be arranged. Hence safe handling of the deceased would need to be considered by those occupationally exposed.

It should be noted, however, that a deceased person externally exposed to a lethal amount of radiation would not become radioactive, nor require special precautions, unless they are externally contaminated and still have radioactive

material on them. Before handling, contaminated bodies should be evaluated by radiation safety personnel wearing protective clothing such as butyl gloves, mask and gown as well as a personal dosimeter.<sup>9</sup> It is questionable whether this is likely in a volatile conflict context in a low-income country.

Considering other constraints, the issue of unidentified bodies could pressurize the work of coroners, and lack of mortuary space might highlight the need to establish special disaster mortuaries. There may be incineration issues for cremations, depending on the type of radiation source, but burial would not constitute a radiation hazard.

Most importantly for civilians, if procedures such as identifying the deceased, notifying next of kin, conducting post-mortems and issuing death certificates are not carried out, there may be consequential issues for families in proving rights to property, other inheritance or benefits – but would countries entrenched in armed conflict take pains to ensure that such procedures are carried out?

### *Humanitarian aid considerations*

The humanitarian response to a radiological dispersal incident would be similar to that required to cover basic needs of a displaced or deprived population. Conflict and security concerns would nevertheless limit aid agencies' presence on the ground and access to people in need. Red Cross and Red Crescent volunteers and medical auxiliaries would only be allowed to work in the so-called "clean area" outside a hazard exclusion zone.

Rapid needs assessment profiles would need to prioritize areas of operations among displaced populations in affected areas, given that local community "life support" systems and social support networks would be severely disrupted. If evacuation were to be implemented, destitute evacuees might have to reside in temporary shelters in public or abandoned buildings or with local families, and would need supplies of commodities such as safe food, clean water, clothing, blankets, hygiene kits, jerry cans, generators, and cooking and household equipment.

Some humanitarian agencies would likely have pre-positioned regional emergency stockpiles to draw upon. The ICRC, in co-operation with the Red Cross or Red Crescent Society, generally delivers emergency relief to civilians in conflict-ridden countries, but assistance could only be piecemeal in the face of the immensity of needs and access constraints.

Canned or sealed containers of food would still need to be washed before opening, whereas fresh food or unpackaged foodstuffs left in the open in the immediate vicinity of a radiological dispersal blast or contaminated with radioactive dust during the cloud passage would not be edible. The food security situation could be dire, especially as many children in conflict zones are likely to

9 See AFRRRI Medical Guidelines, above note 7, p. 29.

suffer from some form of malnutrition or chronic illness, needing nutritious supplementary food. Water in sealed or closed systems would generally be “safe”, although any additional daily trucking and delivery of drinking water to hospitals and health facilities could prove an enormous logistical burden.

Special-needs populations, such as infants, the elderly and the physically impaired, would warrant particular attention, and family tracing and reunification might be needed for separated children and relatives. With education disrupted and the fear of a continued radiation threat preventing children returning to school or concentrating on studies, aid agencies might even consider provision of emergency school supplies and remote out-of-classroom learning opportunities. Continuity of livelihoods, too, might be difficult in the face of sporadic attacks, breakdown of utilities and diminishing employment opportunities.

### *Consequence management*

There would be numerous considerations for government authorities in the aftermath of a catastrophe-level incident. The overall response should be in line with national plans and arrangements – if they exist. A large-scale evacuation would require considerable transportation means and a government may request military assistance, should this be necessary. Any mass population movement is likely to put pressure, too, on public service utilities, necessitating further rehabilitation of vital components of local water and sanitation infrastructure.

Overall, the major clean-up process could prove long and difficult in trying to detect any remains of radioactive contamination in cracks on surfaces. The likely particulate nature of the radioactive source would mean that airborne particles would be deposited on underlying surfaces, and while the “plume” hazard period is short, the deposited material will persist until it decays, or is weathered away or removed. Water jets and sandblasters would be required for cleaning surfaces. Furthermore, vehicles, equipment and clothing exposed in the hazard zone would require decontamination. Shortages of water and electricity outage would also impose severe restrictions on any other than essential use, and alternative supplies might be needed. Disruption of critical infrastructure and utilities during the clean-up and monitoring period would also cause knock-on economic damage and considerable concern.

### *Environmental contamination*

Contamination of the environment, such as surface contamination in soil arising from an airborne radiation release, can be transferred through the food chain and subsequently eaten. Generally, as most radioactive sources, and hence most incidents, involve only small masses, food supplies from exposed crops are most likely to remain safe, although environmental and health and safety authorities would need to monitor this.

Any surface water would likely be contaminated by radiation fallout and can be detected using radiation devices, although this is quite difficult and would

require competence in reading such equipment. Water authorities would hence need to take steps to remove any particulates from drinking water by using reverse-osmosis plants, but these are not readily available in a poorly resourced country. Further monitoring of the quality of groundwater would be required, although radioactive decay would reduce contamination levels over time.

### *Security issues for humanitarian organizations*

In armed conflict situations, humanitarian organizations are constantly weighing up security constraints preventing access to vulnerable groups, and similarly, in a CBRNE incident humanitarian organizations would be restricted in helping the affected population within the hazardous and secured areas.

If aid agencies are constrained by lack of capacity or high-security risk, military contingents may be requested by a government to assist in delivery of a relief effort. In complex emergency situations, civil/military liaison would generally be confined to intergovernmental organizations such as UNSECOORD, UNHCR and UN-OCHA, whereas non-governmental humanitarian organizations would likely restrict direct contact with a military contingent in order to maintain their core humanitarian operating principles of neutrality, impartiality and independence.

### **Conclusions**

In a climate of increasing terrorist activity, new “dirty wars” with the deliberate release of CBRNE materials make it difficult for humanitarian organizations in the absence of state security to protect vulnerable civilian populations and ameliorate human suffering when they are also restricted in their outreach and movements.<sup>10</sup> Many international aid organizations may have already left a conflict area in the face of danger and lack of neutral “humanitarian space”. The enormous scale of violence, logistics obstacles and security constraints in an escalating armed-conflict context makes humanitarian assistance to the most vulnerable an almost impossible task.

In a dirty bomb incident, security restrictions may limit humanitarian assistance to emergency measures such as the provision of safe shelter or “temporary safe havens” and essential relief, clean water and food. If security conditions permit access, humanitarian agencies might also give support to overstretched hospitals and clinics, special-needs populations, elderly people and vulnerable groups. The greatest issue, however, would be in helping to mitigate the psychological stress and social disruptive effects of radiological and chemical terrorism.

Essentially, the question arises as to the extent to which humanitarian organizations would have sufficient knowledge of protective measures and

10 See “Iraq: growing needs amid continuing displacement”, 30 January 2007, available at [www.unhcr.org](http://www.unhcr.org) (last visited 25 June 2007).

restrictions in CBRNE incidents to be able to provide support to affected civilian populations.

## **A pandemic scenario with global catastrophic effects**

### **Chronology of events**

Outside an armed conflict, major emergencies such as pandemics have similar disruptive impact, although the development of pandemics may progress in phases and allow preparation to some degree for a humanitarian response by early action and preparatory measures. Again, the supposed scenario looks at a potential unfolding of events and focuses on planning and preparedness.

### *Emergence of a novel strain of influenza*

A highly virulent virus with a new sub-type – to which there is no existing population immunity – is ravaging the world. Despite early warning by the World Health Organization (WHO), accelerated by the rapid pace of international travel and trade, “Dragon flu” took fewer than four weeks to spread from south-east Asia through the Middle East to Egypt and the African continent, making a worldwide influenza pandemic threat stark reality. The devastating wave was observed simultaneously, not only in North America but also the southern hemisphere, with up to seven million deaths in Asia and epidemics in many other parts of the world. Forecasts of a global death toll of many millions could make it very serious, with potentially similar indications to the deadly 1918 pandemic of increased risk of infection, particularly among young adults.

### *Emergency measures*

World influenza experts met to discuss the new virus and advise on action. WHO warned of an impending humanitarian disaster and urged local and international media to boost coverage of pandemic flu to make more and more countries across the world aware of the uniqueness of this highly infectious disease. It advised governments urgently to prepare for a cumulative clinical attack rate of up to 50 per cent of the global population, and to expect a case fatality rate of 3 per cent. Stock markets plunge and concern for gross domestic products (GDPs) rises as the pandemic impacts on the global economy. Attempts to contain initial outbreaks and slow down the pace of spread prove difficult as WHO early control measures are overtaken by the vicious virus. Europe and the United States, struggling to contain epidemics taking hold, brace themselves and activate rehearsed contingency plans while imposing strict public health infection control regimes.

The European Union called an emergency debate, the United Nations and the International Partnership on Avian and Pandemic Influenza held teleconferences on the implementation of response measures, while the WHO and the Pan

American Health Organization (PAHO) made urgent appeals for additional funding for Africa, south-east Asia and Latin America. The pandemic has severely hit sub-Saharan countries, where one in twenty people die and one in two are struck down by acute respiratory illness, putting thousands more lives at risk of bacterial pneumonia and respiratory failure. A lethal flu pandemic strain, added to HIV/AIDs and other chronic health conditions in poor countries could cause millions of deaths and uncounted cases of disease and hospitalizations. It would also have grave economic consequences, impacting especially on low-income countries and impoverished people, and make the UN Millennium Development Goals even more difficult to achieve.

### *Port health and displaced people*

Learning from past experience during avian flu outbreaks, governments were advised that it would be futile to consider further evacuation of their national citizens from other foreign countries, and most embassies have refused to support repatriation of deceased nationals. At a high-level summit, EU leaders urged member states not to close their borders after flights operated by the main airlines to countries in south-east Asia had been suspended, but advised against all but essential travel to affected countries. Health-screening control measures at borders were deemed ineffective, and the ban imposed on international travel had severely affected trade and tourism. In some African countries border closures had triggered clashes between police controls and nomadic tribes, also stranding thousands of migrant workers and transient communities, disrupting traditional livelihoods. Pandemic implications for internally displaced people caught up in armed conflict situations, such as in Gaza, the West Bank, Iraq, eastern Chad, Sudan, northern Uganda and Colombia are dire, as their citizens are already disadvantaged without guaranteed state security and “protection rights”.

### *Infection control measures*

The numbers of people with influenza in all countries throughout the world continue to rise, but there is very little evidence-based data available as national surveillance systems begin to collapse, despite the enormous efforts of the WHO. Well-resourced Western countries try to reduce the control and spread of the virus through targeted distribution of anti-viral drugs, while in low-income countries excess mortality rates soar. An extraordinary meeting of the United Nations nominates an Emergency Relief Co-ordinator for Pandemic Influenza and Special Representative for Africa – the continent most severely affected. The African Union appeals to Western countries to increase their contribution of anti-viral drugs to the WHO global stockpile for low-income countries where stocks are alarmingly low and distribution restricted to high-risk groups. The ethical question of leaving out other especially vulnerable groups causes great controversy.

### *Public information campaigns*

Ministries of health do their utmost through public health advice and services to mitigate the spread, but many people fail to understand the gravity of the situation. Aid agencies too drive community information campaigns with messages “Respiratory and hand hygiene – as coughs and sneezes spread diseases”, but lack the local skills of outreach hygiene-promoters and animators, who also fall ill with this deadly strain of influenza. As human resources diminish within all sectors, local radio programmes try to relay self-help messages and reassure citizens that only a portion of the population will be infected with influenza but fail to mention that the Dragon Flu virus may re-emerge in several pandemic waves, the second possibly more severe than the first.

### *Increasing demand, diminishing resources*

In developing countries, national stockpiles and community pharmacies are rapidly depleted, while the demand for protective face masks and antibiotics increase public stockpiling and black market trading. In Zimbabwe, Angola and other southern African states, armed forces are mobilized to control volatile security incidents and social instability as demands for scarce commodities and food staples grow.

Driven by the perceived level of risk, extensive public hysteria and media coverage, the United States and China import additional supplies of ventilators, while health economies in low-income countries suffer from having too few ambulances, laboratories, pharmacies and medical treatment centres to cope with the growing demands. Lack of ventilators and oxygen supplies mean that only life-threatening surgery and treatment can be performed, and humanitarian aid agencies contribute medical teams and equipment to developing countries to support swamped hospitals and community health posts.

### *Overwhelmed health facilities*

New laboratory results obtained by WHO reveal that the virus shows indications of becoming resistant to frontline antiviral drugs, evidenced by increasing numbers of infections and excess deaths worldwide. Some countries declare “a state of emergency” as health systems and other vital infrastructure start to collapse.

As public panic ensues and people become more anxious about their health and survival, community clinics are overrun with hundreds of outpatients, and short-staffed, under-resourced health facilities everywhere are overwhelmed.

Reports of hospital closures and withholding of health services add to the burden of health in countries already coping with high morbidity. Also, rumours abound of some rural doctors withholding treatment from elderly people in favour of working-age adults, youngsters and children.

With depleted public services some of the worst-hit countries in south-east Asia and Africa have to resort to traditional medicine or simply go untreated.

### *Healthcare issues*

The fear of contracting a new deadly virus which may lead to millions of deaths and orphaned children haunts those already living in poverty and deprivation. People who are chronically ill, frail, elderly or suffering from HIV/AIDs fear that their weakened immune systems will succumb to new infections. The availability of voluntary support groups, traditional birth attendants and outreach health workers drastically declines, and the WHO deploys additional resources to bolster ministry of health attempts to maintain core essential services.

Pharmaceutical companies in many countries request foreign help to create a pandemic vaccine for the new strain and sub-type as they lack the necessary technology and expertise. Only certain categories of workers and high-risk groups will be offered the vaccine initially, but the manufacturers predict that it will be six months before the first batches become available.

### *Impact on public-service sectors, commercial enterprise and industry*

With human resources greatly diminished in all sectors, efforts to continue livelihoods as far as possible are hampered by public transport disruptions and absent operators and drivers. As more and more workers go sick and services decline, mounds of rubbish pile up in gutters and streets, causing environmental pollution and a massive public health risk due to the attraction of rodents, insect pests and other vectors and domestic scavengers.

National emergency planning arrangements are activated in most countries as fuel shortages take hold, affecting critical national infrastructure and impacting severely on commercial and industrial activity and everyday life. Imports decline and retail trade suffers everywhere as shops and stores close, markets dwindle and more people are forced to stay at home. Developing countries see their population's coping capacities decline and have no means of providing compensation for financial loss.

### *Social distancing measures*

The closure of schools and educational institutions are in force, but other social distancing measures, such as the prohibition of large public gatherings, prove harder to enforce. Following decisions in most countries not to cancel national days and religious events, the public are advised to avoid crowds wherever possible and to restrict celebrations to family circles. Consequently many leisure and sporting events and tourist attractions almost everywhere see a considerable fall in demand as people stay away.



### *Dignity for the deceased*

While rich Western countries are actively turning greenfield land into landscaped burial grounds and cemeteries,<sup>11</sup> less-resourced countries have no alternative but to consider mass graves, raising issues of body identification and measures to enable future retrieval. Given the unexpected number of deaths, some countries contemplate erecting temporary tented mortuaries in central parks and wasteland, but lack sufficient refrigeration units. Sickness among cemetery and crematoria staff aggravates funeral delays, and perceived contagion from dead bodies also hampers the performance of traditional rites and rituals to honour the deceased.

### *Recovery from the pandemic*

Having acquired immunity to further outbreaks of this strain of influenza, those people who have survived and recovered from the pandemic are mobilized to assist others to cope. Exhausted support services and aid agencies start to develop comprehensive staff rosters and action plans in preparation for the second wave of the flu pandemic, forecast with a lull of only twelve weeks.

### **Pandemic influenza preparedness**

#### *A newly emerging influenza strain – a question of when, not if*

Worldwide pandemics of influenza resulting in high morbidity and mortality occur when influenza A-viruses undergo major antigenic shifts. A new human strain of influenza emerges – a novel A-virus subtype, markedly different to previously circulating flu viruses.<sup>12</sup> A pandemic can arise at any time of the year, in several waves of infection, and spread around the globe within about four to six months, given the high rate of international travel. Few people will have initial immunity, allowing the virus to spread rapidly from person to person with increased and sustained transmission in the population, and potentially affecting millions of people in many regions and countries. The world has already had several threats with pandemic potential, making the occurrence of the next one just a matter of time.<sup>13</sup>

#### *Clinical considerations of the pandemic influenza virus*

Historical accounts can illuminate planning for possible future pandemics, but each pandemic life-cycle would be different, and until the novel influenza virus starts circulating it is impossible to predict its characteristics and full effects.

11 “Greenfield graves for bird-flu victims”, *The Times*, 5 March 2007, p. 23.

12 “Bird flu showing new strains and is heading west”, *CC News*, 16 April 2007, [www.ccnmag.com](http://www.ccnmag.com) (last visited 25 June 2007).

13 “Pandemic Preparedness”, available at [www.who.int/csr/disease/influenza](http://www.who.int/csr/disease/influenza) (last visited 25 June 2007).

However, it is likely to be more serious than “ordinary” flu and may cause illness in 25 per cent to 35 per cent of the population. Epidemic peak would be after *circa* fifty days and a serious pandemic could cause tens of millions of deaths worldwide. Secondary illnesses and complications might be around 25 per cent, and hospitalizations 4 per cent, with some 25 per cent requiring critical care resources – doctors, nurses, beds and equipment.<sup>14</sup> Influenza infections may exacerbate underlying medical conditions and may cause serious complications such as bacterial pneumonia.

Seasonal influenza can affect any age group, but usually causes the most serious complications in vulnerable groups such as elderly and chronically ill people. Remarkably, in the 1918 flu pandemic young adults were the most severely affected and many victims died rapidly of viral pneumonia. However, global and national demographics have changed greatly since then, as have health standards and medical advancement in developed countries.

### *Infection control measures*

National policies on the type and use of protective face masks for clinicians would need to be made. In a healthcare setting, the option may be to use surgical face masks for only those at risk of spread from close contact with patients who are coughing or sneezing, whereas high-efficiency face masks would be needed by clinicians performing aerosol procedures. For others it would be futile to wear face masks as they may not fit well enough to provide sufficient protection and would only cause an added spread of infection and potential environmental hazard in disposing of them.

### *Medical countermeasures*

In developing countries there may be different models and levels of care provided by health services. Some countries are developing a pre-pandemic vaccination strategy using the avian flu H5N1 vaccine, and the WHO is exploring the feasibility of setting up a world stockpile with a means to ensure that developing countries are able to access pandemic flu vaccine supplies.<sup>15</sup>

Medical countermeasures such as antiviral drugs will not be a panacea. Apart from attempts to contain initial spread during the early stages of outbreaks, general preventive prophylaxis using antivirals are not regarded as an effective or practical response strategy for a pandemic, as millions of doses would be required. Early antiviral treatment, within the first twelve hours, is thought to reduce by one day the duration of an infection and the likelihood of complication and further spread of the disease, but it is not possible to know their full effectiveness until the virus is circulating. However, these drugs would be the only major clinical

14 Estimates of likely impact.

15 Robert Roos, “WHO: global H5N1 vaccine stockpile may be feasible”, available at [www.cidrap.umn.edu](http://www.cidrap.umn.edu) (last visited 25 June 2007).

countermeasure available in the absence of a specific vaccine for the new strain of influenza.

### *Priority groups and ethical issues*

Public concern and demand for infection control treatment and medication from primary care services would undoubtedly be high. Limited stocks would possibly reduce availability of antiviral drugs during a pandemic, necessitating prioritization among essential and frontline workers, at-risk groups and infected individuals. Priority groups might include healthcare workers, patients with early signs of complications, high-risk groups, elderly people and children under 16 years.

Ethical questions would arise in many countries around the prioritization of treatment for pandemic flu complications over other serious illnesses, and the rationing of intermediate care beds, ventilation equipment, antiviral drugs, antibiotics treatment and future vaccines. If medical resources and treatment were targeted to young adults and the working population, there could be a risk of discrimination, especially ageism, and failure to respect all members of society equally. What rights of access to healthcare would transient populations, refugees and other displaced people have?

In the distribution of scarce resources based on needs assessment, aid agencies would also wish to respect other humanitarian principles, such as treating people with concern and dignity, fairness, “minimizing harm” – physical, psychological, social and economic – and inclusiveness, taking account of the disproportionate impact of the pandemic on certain groups.

Healthcare staff would also be affected, perhaps disproportionately so, given their potential exposure to infectious people. Not only would some become ill themselves, but others could be absent because of the illness of family members, closed schools and lack of childcare. This could cause a conflict of interest between personal and professional priorities in caring for sick relatives and maintaining job demands.

### *Distribution of reduced medical supplies – a logistical challenge*

With reduced services, “just-in-time” hospital delivery systems would not be effective. Community pharmacists would run out of supplies of drugs, and pre-positioned buffer stocks and planned community-level arrangements would need to be in place in readiness for the distribution of anti-viral drugs and antibiotic treatment to individuals or their helpers. In industrial countries, systems set up with special pandemic call centres and telephone helplines may become overloaded, with limited capacity for initial triage and referral. Might some countries even use a “military-style triage” system in exceptional circumstances in worst-case times?

There could be many other difficult questions. For example, how would antiviral drugs be affordable and accessible to impoverished populations in

different corners of the world? And how would populations who are isolated in rural districts be helped, and those who do not have the mobility or someone to collect a course of treatment? Moreover, without a comprehensive national database system to validate and register distribution of antiviral drugs, how would misuse and black-market trading be controlled?

Given the logistical challenges of providing healthcare to remote communities and the reduction in pharmacy supply chains, would co-operative ventures form to share resources and stocks and operate medical distribution systems?

### *Other healthcare needs*

Consideration would also be needed to ensure treatment and care for people in residential and mental health institutions and other densely populated centres where influenza spread would probably increase. But who would provide for healthcare needs of people suffering malnutrition, impoverished street children, homeless destitutes, newly arrived immigrants and forced migrants?

### *Mortuary and burial issues*

Provision for excess mortality and disaster or temporary mortuaries might also need to be considered as well as sites for burial and cremations and religious issues. Clearly, cultural and religious myths would need to be dispelled about the burial of infected bodies.

### *Mass vaccination*

Once the new strain of influenza had been detected, manufacturers and pharmaceutical companies would begin the development and licensing of a new vaccine for all age groups above 6 months. Ministries of health with the support of medical organizations would need to mobilize mass immunization campaigns, and aid agencies might be requested to donate trained vaccinators and additional supplies of automatic syringes and refrigerators for cold chains.

### *Public communications*

Guidance and health information would need to be disseminated to the population at an early stage of an impending pandemic. But how would health promotion material be relayed to transient people and migrant and mobile communities who do not have access to local media channels? And where health clinics and posts have reduced services, would health promotion messages by other means be feasible and effective?

### *Impact on livelihood economies and public services*

Social and economic disruption and restricted movements would make it difficult to sustain livelihoods and might deny access to basic health care, particularly for

women and children. With reduced capacities for crop cultivation and production, the food security situation may have to be assessed, and supplementary feeding considered for malnourished children in developing countries.

Small-scale cottage industries and income-generating opportunities without resilient business continuity contingencies would mean reduced household economies, and less spending on food, nutrition and health and essential asset investment. Livelihood support measures might include bolstering local capacity, using local skills and deploying people where best utilized.

Government national preparedness and cross-ministerial response plans would need to address continuity of essential public services such as power, food and drinking water supply, transport, communications and community health services, and might even consider bringing back retired professionals. But how will humanitarian support organizations maintain and sustain operational capacity when social mobilization means are limited?

### Summary of the likely characteristics and consequences of a pandemic

The features of a global pandemic might be:

- rapid geographical spread through trade and travel links;
- no previous immunity and widespread illness;
- millions of deaths;
- possible age-specific mortality;
- overwhelmed medical and health facilities and resources;
- lack of hospital beds and critical care facilities;
- short supply of medical countermeasures and stocks;
- potential resistance to antiviral drugs;
- significant economic and societal effects;
- implementation of control measures and social distancing;
- staff shortages and reduced productive capacity in all organizations and sectors;
- limited services and reluctance to travel and to use public transport; and
- severe disruption to public and commercial services.

Impact on the internal functioning of organizations would include areas such as production, service delivery, fund-raising, finance, administration, human resources, travel and transport.

Individual organizations may also have staff deployment restrictions, and occupational health issues such as duty of care, health & safety, and provision of protective clothing. Essentially, limited surge capacity might hamper international humanitarian aid support to a global pandemic. Every organization would therefore need to develop their own “business continuity” plan to ensure robustness and resilience of their services.

## International humanitarian action

Response to a pandemic would involve wider international engagement between regional groups, intergovernmental organizations and multinational fora. The WHO, as the leading international health organization, the European Centre of Disease Prevention and Control (ECDC) and other developed health systems would offer advice, guidance, technical support and scientific expertise to governments, whereas regional bodies such as the European Union and the African Union might have an overall co-ordination role of their continents.

Overarching preparedness measures would be to ensure

- that the pandemic contingency plans were in place;
- global horizon scanning and initial surveillance;
- early warning and alerting mechanisms;
- stockpiling of antiviral drugs and antibiotics;
- means of rapid public communication; and
- the strengthening of vulnerable risk communities.

Preparedness and rapid response mechanisms of UN country teams would also be necessary as countries without comprehensive multisector pandemic preparedness and action plans might request international support.

During the initial pandemic period, humanitarian organizations would have to consider operational tasks such as mapping institutional capacities, planning and deployment of response surge capacity, supply of personal protective equipment for healthcare staff, positioning stocks of materials and relief supplies, and organizing logistics and delivery systems. They would also be concerned with social support to vulnerable groups and displaced populations and maximizing safety net activities.

Medical organizations might be tasked with assisting in the application of targeted public health actions and strengthening hospital capacity at provincial and district levels in efforts to sustain medical and health systems, services and resources.

Other resilience measures might involve training of local health staff and community leaders, supporting ministries of health with hygiene promotion and eventually assisting with mass vaccination campaigns.

## Conclusions

Contingency and intervention planning for a public health emergency of international concern will be essential, and pandemic preparedness plans can essentially be used as a framework for any novel highly infectious disease threat or epidemic that would affect large numbers of people.

WHO has defined phases in the progression of an influenza pandemic, from the first emergence of a novel influenza virus to wider international spread in a pandemic. This allows a programmed escalation of the response, although transition between phases may be rapid and distinctions blurred.

Emerging avian flu viruses have already demonstrated their ability rapidly to reassort and mutate to create a new strain that may eventually be passed between humans. Once a new subtype of a virus spreads to pandemic proportions the WHO and other health organizations will be looking at available critical and epidemiological data for early control and containment measures. Early action and emergency preparedness will be required to aid national responses and support ministries of health, and UN and other humanitarian organizations. Inter-agency pandemic influenza contingency plans with response strategy, implementation and support plans would therefore need to be ready for the emergence of a global pandemic.

### **Final remarks**

Chemical, radiological, nuclear and explosion incidents and newly emerging diseases will present new risks and challenges to relief agencies and civilian populations. Events such as suicide bombs and the deliberate release of dangerous substances will happen without warning and activate official command, control, co-ordination and emergency response procedures. CBRNE incidents will have major political ramifications and trigger tight security measures, restricting humanitarian access to civilian populations in need. With the increasing threat of terrorism, relief agencies operating in armed conflict environments and complex emergencies should be aware of the likelihood of major emergencies, in which they might only have limited humanitarian space to operate and relieve the suffering of populations in need. Humanitarian assistance agencies can adopt an “all hazards risk approach” for contingency planning and preparedness, strengthening their security and emergency operational procedures and stockpiling and logistics capacities to provide appropriate post-incident support.

A gradually occurring novel disease with pandemic potential and worldwide impact over a protracted period would also have a considerable disruptive impact, particularly on the health and social welfare sectors. Preparedness measures could be enhanced by planning for a pandemic on an inter-agency basis and building robust resilience of services, and strengthening local support organizations and their coping capacities.