

# ISC WORKING GROUP ON INFECTIONS IN CATASTROPHIC AREAS (ISC-WG ICA)

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## Aim of the Working Group (WG)

ISC received a proposal to create a working group on infectious diseases in areas after catastrophes. Its aim is to a) investigate prevention & therapy and b) explore the epidemiology of infectious diseases occurring in conjunction with various anthropogenic and non-anthropogenic (natural) disasters. This WG should try to contribute to the knowledge of pathogenesis and improve outcome of infectious diseases in areas after anthropogenic (war, genocide, terrorist attack, industrial disasters) and natural catastrophes (earthquake, floods, tsunamis, hurricanes, volcano eruptions).

## Background

There is very little data and no prospective research possible in the field of disaster medicine, including infectious diseases.

“Unpredictability” is an inherent element of a disaster situation.

After World War II the illusion of world peace disappeared 5 years later with the Korean War when, for the first time, biological weapons were officially used on insects and rats infected with bubonic plague. Thus, both anthropogenic and natural disasters belong to everyday life.

Medical conditions related to these unexpected events are different:

- a) Affects masses of patients (population)
- b) Appear unexpectedly
- c) Public and health sector is unprepared

Medical consequences of disasters are i) immediate, ii) consequential or iii) late and may be apparent or latent (1,2). Infectious diseases belong to ii) and iii).

**Table 1.** Types of disaster (adapted from Petrovic *et al* 2002)

Anthropogenic (violent)	War (civil or international) Genocide Massive terrorist attack (fire, nuclear, chemic, biological, mixed)
Anthropogenic (non-violent)	Famine Industrial disasters
Natural	Earthquakes Floods, tsunamis Volcanic eruptions

## Infections in anthropogenic disasters

There are two groups of anthropogenic disasters – i) violent and ii) non violent. Violent include genocide, international war or civil war, terrorist attack and non violent include mainly industrial (incl. nuclear) catastrophies and famine.

Within the last three decades, several catastrophies with severe medical consequences, including infectious diseases appeared. Some of them are highlighted in table 2. Starting with wars, five major genocides within last 30 years has been repored.

- A.** First, 1975-1977 Pol Pot regime in Cambodia in the name of Agrar socialism murdered 2.2 million Khmers, but about only 1.6 million have been found in mass graves (Killing Fields), killed in violence. An estimated 0.4 - 0.6 million died of malaria, TB and diarrhoeal diseases, since only 1 pharmaceutical plant was kept open producing chloramphenicol, penicillin and sulphonamides. Anti-TB and antimalarial compounds were neither produced nor imported. All hospitals were closed between March 1975 and December 1975 and all but two doctors who stayed in the country were murdered.
- B.** From 1984 until Jan 6, 2005, the Sudanese governing militia from north in the South Sudan has carried out chronic genocide. There are only 3 hospitals in the Southern Sudan area. About 2.1 million died and 5 million were displaced, but from 2.1 million deaths only 0.3 million were directly killed by fighting guerillas. More than 1.5 million died on malaria, leishmaniasis, and tuberculosis. About 2 million suffer from onchocercosis (with blindness), chronic malaria, TB and leprosy since practically all medical infrastructures apart of Juba, Wau and Kapoeta was destroyed.
- C.** Another nationally based war similar to genocide was executed in 1993 in Bosnia Herzegovina, then in 1995 at the Croatian Serbian border (Vukovar, Osijek) followed by Kosovo in 1999. In contrast to Sudan, from 180 thousands deaths, 99% were killed by fighting armies or executed as civilians. Less than 1% died of infection.
- D.** In 1995 a tragic genocide occurred in Rwanda, with 800 thousands civilian deaths within 100 days, followed by massive displacement of 250 thousands citizens to neighbouring countries (Burundi, Zaire, Tanzania, Uganda) reported by UNHCR. About 80 thousands died on infectious diseases, mainly children due to the dehydration after diarrhoeal infectious disease. This was very different from the former Yugoslavia and similar to South Sudan.
- E.** In 1996 in East Timor another massive displacement due to ethnic “cleansing” similar to genocide led to several thousands deaths among civilians due to diarrhoeal diseases and malaria similarly to Rwanda.

There is little data on infectious disease outbreaks in areas of civil war from Croatia. Bosnia Herzegovina and Kosovo have been reported, because in these areas the destroyed medical infrastructure was replaced by Serbian (or vice versa) international army forces. Despite the facts that the hospital in Vukovar was totally destroyed and wounded patients killed and the hospital in Sarajevo was suspended from supplying drugs (including antibiotics), some cases were transported to civilian houses and some were running with a limited operation plan (Sarajevo). I have personally assisted IRC in Arad and Timisoara during the attack of the Securitate on hospitals and we moved all patients to civilian flats to avoid the killing of wounded patients in Romania in 1989. During bombing in Zagreb in 1992-1993, ICUs were rapidly set-up outside the hospital that was sometimes the subject of artillery attack (like in Sarajevo and Vukovar 2-3 years later) and all patients were removed and no infection diseases outbreaks were observed.

**Table 2. Anthropogenic catastrophes**

	Country	Year	Mortality	Other health consequences	Commonest cause of death
<b>Violent</b>					
<i>Civil wars</i>	South Sudan	1984-2005	50%	Psychotrauma, Malnutrition, Wounds, Burns	Infected wounds, TB, malaria, pneumonia
	Croatia, Bosnia	1992-1996	< 1%	Psychotrauma	None
	Liberia, Sierra Leone	1990-2004	< 5 %	Mutilation	Wound infections
	Timor	1995-1996	5-10%		Wound infections, malaria
<i>Genocide</i>	Cambodia		30%	Malnutrition, Psychic trauma	
	Rwanda		25/30%	Malnutrition, Psychic trauma, Mutilation	
<i>Terrorist attack</i>	US	2001	< 1 %	Crush syndrome, Polytrauma	Wound infections, Crush syndrome, Sepsis, Infected burns, Pneumonias
	Israel	1960-2006	10-20%	Blast syndrome	Infected wounds, Burn sepsis, Burn pneumonia
<i>International wars</i>	Ethiopia vs. Erythrea	1995-2005	10%	Famine, Malnutrition	TB, Pneumonia
	Iraq vs US, UK, UN, NATO	2002	< 1 %		Infected wound, Trauma
	Kuwait vs Iraq	1990-1991	< 1 %		Trauma, Burn infections
<b>Non violent</b>					
<i>Famine</i>	North Korea	1950-2006	<20%	Chronic malnutrition	Influenza, Pneumonia
	Somalia, Sudan	1991-2006	50-100%	Acute and Chronic Malnutrition	TB, Diarrhoea, Measles
<i>Industrial disasters</i>	Tchernobyl (Ukraine, Belarus)	198	Immediate 0% late 10-15%	Acute and chronic irradiation syndrome, Solid tumor (thyroid CA), Leukaemia, Lymphoma	Infections during neutropenia
	Bhopal (India) Kyanid plant explosion	1972	After 48 hours 20-30%		Pneumonia
	Sverdlovsk biofactory explosion (Soviet Union)		After 1-3weeks 400 deaths		Anthrax pneumonia
<b>Combination</b>					
	Sudan (Darfur, South Sudan)	1984-2005	Days-years 2.5 million deaths		TB, malaria, parasitic diseases, pneumonia, diarrhoea

Vice versa, the situation was different during bombing attacks in Israel (Jerusalem) where most casualties developed post-traumatic sepsis due to *Acinetobacter* spp. and hyphic (mould) fungal organisms due to contamination of wounds. While blast, crush syndromologic cases and most of polytraumas in Vukovar died, the majority of cases in a perfectly functioning infrastructure and limited access of terrorist attacks survived.

The situation in New York in September 2001 was different, where the majority of cases died immediately. Only a few patients developed infection while hospitalized.

Apart from bombings during World War II, when no antibiotics were available in Germany, Japan and Eastern Europe, those who survived and were affected by crush syndrome or blast syndrome (severe burns) died of early onset burn sepsis or polytrauma related sepsis from contaminated wounds and burns. After the introduction and availability of antibiotics and a massive population-based vaccination programme (against tetanus) survival was notably better.

### **Infections in non anthropogenic natural disasters**

Table 3 describes the commonest events resulting to natural disasters. The most important factor for the outcome of affected/wounded is presence or absence of medical infrastructure in that particular area (i) and transport/communication facilities (ii), size of disaster in term of urban versus rural areas (iii). Therefore, losses of life in first 24 hours – immediately due to earthquake or flood depend on access to health care and transport. Number of casualties and infectious diseases after floods therefore are very different from Tsunami in India/Indonesia and Katrina in US (expected and supported by immediate action of civil guard, police and army) where in chronic phase deaths due to infectious diseases in New Orleans were less than 50 and in Indonesia about 10 thousands.

**Table 3.** Infectious risk resulting from natural disasters

<b><i>Earthquakes</i></b>	
Armenia 1998	Crush syndrome sepsis, wound infections, diarrhoeal diseases
Turkey 2004	cellulites, gas gangrenes,
Pakistan 2005	Crush syndrome sepsis, hepatitis A
Iran 2006	Crush syndrome, gangrenes
<b><i>Floods, Tsunamis</i></b>	
Jang-ce-tiang (China)	Hepatitis A, liver flukes, parasitic diarrhoeal diseases
Tsunami 2005 (Indonesia, Sri Lanka, India)	Diarrhoeal diseases (early), malaria, dengue (late)
Morava flood 2002 (Czech republic)	Leptospirosis but no major epidemics
Hurricane Katrina 2005 (US)	No major epidemics
<b><i>Volcano, burns</i></b>	
Lwanza (Zaire)	Diarrhoeal diseases, typhoid fever, shigellosis

## Conclusion

There is very little data and no prospective research possible in the field of disaster medicine, including infectious diseases. The ISC Working Group on Infections in catastrophic areas (ISC-WG ICA) was therefore established. It aims to a) investigate prevention & therapy and b) explore the epidemiology of infectious diseases occurring in conjunction with various anthropogenic and non-anthropogenic (natural) disasters.

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