WHO/CDS/NTD/DCE/2007.4

Communicable disease risk assessment: protocol for humanitarian emergencies

June 2007

Contents

Acknowledgements

Edited by Dr John Watson, Dr Michelle Gayer and Dr Máire Connolly of the Programme on Disease Control in Humanitarian Emergencies (DCE), Communicable Diseases cluster (CDS/NTD).

This document is a product of the Communicable Diseases Working Group on Emergencies (CD-WGE) at World Health Organization (WHO) headquarters. The CD-WGE provides technical and operational support on communicable disease control to WHO Health Action in Crisis cluster (HAC), WHO regional and country offices, ministries of health, other United Nations agencies, and nongovernmental and international organizations. The Working Group includes the departments of Epidemic and Pandemic Alert and Response (EPR) and Control of Neglected Tropical Diseases (NTD) in the Communicable Diseases (CDS) cluster; Roll Back Malaria (RBM), Stop TB (STB) and HIV/AIDS in the HIV/AIDS, Tuberculosis and Malaria (HTM) cluster; departments of Child and Adolescent Health and Development (CAH) and Immunization, Vaccines and Biologicals (IVB) in the Family and Community Health (FCH) cluster; Food Safety, Zoonoses and Foodborne Diseases (FOS) and Public Health and Environment (PHE) in the Sustainable Development and Healthy Environments (SDE) cluster; Injuries and Violence Prevention (VIP) and Nutrition for Health and Development (NHD) in the Noncommunicable Diseases and Mental Health (NMH) cluster; Security and Staff Services (SES) in the General Management (GMG) cluster; and the Health Action in Crises (HAC) cluster and Polio Eradication Initiative (PEI).

The following people were involved in the development and review of this document, and their contribution is gratefully acknowledged:

Pino Annunziata HAC; Eric Bertherat, CDS/EPR; Sylvie Briand, CDS/EPR; Claire Lise Chaignat, CDS/NTD; Yves Chartier, SDE/PHE; Claire Chauvin, DGR/POL; Karen Ciceri CDS/NTD; Micheline Diepart HTM/HIV; Pierre Formenty, CDS/EPR; Dominique Legros, CDS/EPR; Pamela Mbabazi CDS/NTD; David Meddings, NMH/VIP; Angela Merianos, CDS/EPR; Tim Nguyen, CDS/EPR; Jose Nkuni, HTM/GMP; Salah Ottmani HTM/STB; Suzanne O'Rourke CDS/NTD; William Perea (CDS/EPR); Zita Weise-Prinzo (NMH/NHD).

1. Introduction

Humanitarian emergencies caused by conflict or natural disasters, are frequently characterized by the displacement of large numbers of people, with severe disruption of basic infrastructure, resulting in overcrowding, increased exposure to disease vectors, food insecurity, and lack of access to safe water, sanitation, and basic health services. In populations affected by humanitarian emergencies, the risk of communicable diseases is greatly increased (*1*), with particularly high morbidity and mortality from communicable diseases in acute conflict situations (*2*). Death rates among displaced populations up to 10 that of baseline rates have been reported, with communicable diseases responsible for the majority of deaths (*1*). Diarrhoeal diseases, measles, malaria (in endemic areas), and acute respiratory infections are the most important causes of morbidity and mortality in displaced populations, particularly in the presence of high rates of malnutrition (1). Reducing this risk is a crucial part of protecting these highly vulnerable populations. A systematic assessment of the risk of communicable diseases, based on the best available evidence (risk assessment), is necessary to guide interventions designed to mitigate this increased risk (risk management).

2. Communicable disease threats

The factors that influence exposure to, and facilitate transmission of, communicable diseases in emergency settings are well-described (*1*). The risk of communicable diseases is associated primarily with the size and characteristics of the displaced population: specifically, the amount and availability of safe water and functioning latrines; the nutritional status of the displaced population; the level of immunity to vaccine-preventable diseases such as measles; and the level of access to health care services (*3*). The risks to populations affected by humanitarian emergencies can be grouped together and assessed by disease category in a way that links to specific risks and interventions, as follows.

2.1 Water-borne diseases

Large-scale population displacement often results in poor access to safe water and to adequate sanitation facilities, facilitating water-borne and food-borne transmission of pathogens. In these settings, diarrhoeal diseases such as cholera, typhoid fever and shigellosis can cause epidemics with high rates of mortality (*4*). Hepatitis E, which is also spread by the faecal–oral route, can result in jaundice and increased mortality in pregnant women (*5*). Furthermore, infection with leptospirosis is associated with displacement after flooding and the resulting proximity of rats to humans on shared high ground.

2.2 Vector-borne diseases

Malaria is endemic in over 80% of areas affected by humanitarian emergencies (*6*). Weakened immunity due to malnutrition or co-infection, increased exposure to vectors owing to inadequate shelter and the collapse of health services can increase risk of death from malaria (*6*). Arboviruses such as dengue, yellow fever, Japanese encephalitis and Rift Valley fever; tick-borne illnesses such as Crimean–Congo haemorrhagic fever and typhus; and other vector-borne diseases such as plague are also endemic in areas affected by humanitarian emergencies. Increased exposure to vectors as a result of substandard housing can increase risk.

2.3 Diseases associated with overcrowding

Measles, occurring in populations with low levels of immunization coverage, spreads easily in the crowded conditions associated with displacement, and outbreaks are common (*1*). Crowding can facilitate the transmission of meningococcal disease and may also contribute to the high prevalence of acute respiratory infections in displaced persons. Crowded living conditions can also aid the transmission of tuberculosis infection and diarrhoeal diseases.

2.4 Vaccine-preventable diseases

In addition to measles and meningitis, displaced populations are at increased risk for vaccine-preventable diseases such as polio, tetanus, pertussis and diphtheria when levels of baseline immunization coverage are low.

2.5 Malnutrition

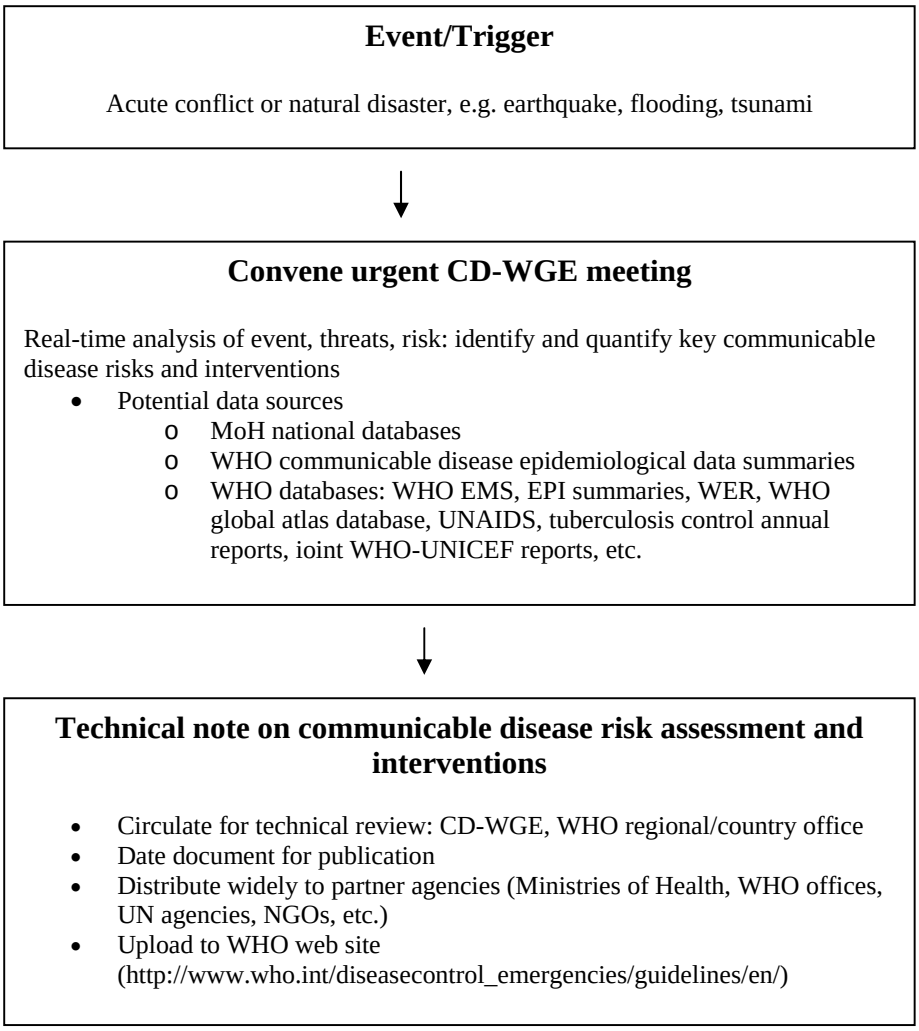
Poor nutritional status compromises host immunity, leading to more frequent, prolonged and severe episodes of infections. Measles, diarrhoeal diseases, acute respiratory infections and malaria can result in high morbidity and mortality in malnourished populations (*7*).

Additionally, public health programmes such as those for **tuberculosis, malaria** and **HIV/AIDS** are at risk of being disrupted by an acute humanitarian emergency. Rapid identification of those on treatment and prompt resumption of services are essential to ensure continuity of care. It is also crucial to reduce the risk of development and spread of drug-resistant strains such as multidrug-resistant tuberculosis (MDR-TB) and extensively drug-resistant tuberculosis (XDR-TB).

3. Risk assessment framework

The process of communicable disease risk assessment described here uses existing data to gauge both the likelihood and the impact of communicable diseases. Assessing risk is critical to identify priority interventions, to inform health planning, and to contribute to the reduction of morbidity and mortality in emergency-affected populations. At the World Health Organization (WHO), the Communicable Diseases Working Group on Emergencies (CD-WGE) uses available evidence and expert opinion to define the risk of communicable diseases (that is, the probability and impact of health effects from communicable diseases) in specific populations affected by humanitarian emergencies. The group consists of 28 technical experts representing the various disease units at WHO headquarters. The CD-WGE meets to assess the risks of communicable diseases in populations affected by humanitarian emergencies and, based on this, to prioritize interventions.

Figure 1. Standard operating procedures for developing a communicable disease risk assessment



3.1 Risk assessment framework: a three-step approach

The potential for transmission of communicable diseases is influenced by a complex interplay of host, agent and environment. Accurately defining risk requires a careful consideration of the potential interactions of all three factors, in this case within the specific context of the area and population affected by the emergency.

In response to an acute humanitarian emergency, the CD-WGE meets urgently to systematically review multiple sources of data (including existing data on outbreaks notified to WHO and other

disease programmes, relevant Ministry of Health data from affected countries and relevant published literature) in order to better define the risk of communicable diseases facing the emergency-affected populations (*Figure 1*). The CD-WGE undertakes a basic three-step approach when developing a communicable disease risk assessment *(Table 1*), modified from established risk assessment methods (*8*). The steps are event description, threat/vulnerability assessment, and risk characterization.

Event description is the process of systematically assessing the type of emergency and the characteristics of the population displaced. Displacement caused by conflict, particularly when rates of malnutrition are high, generally carries a higher risk of mortality from communicable disease than displacement arising from natural disasters (*3*). The size of the displaced population and the duration of the displacement, among other factors, can influence the risk of transmission of communicable diseases.

The process of **threat/vulnerability assessment** identifies potential interactions between the emergency-affected population (host factors), likely pathogens (agents) and exposures (environment) that determine factors that facilitate communicable disease transmission. Population factors include immunization coverage and underlying rates of malnutrition, as well as community practices such as use of bednets and boiling of drinking-water. Cultural practices, e.g. consumption of bushmeat or interaction with domestic animals, may also contribute to communicable disease risk. A comprehensive consideration of likely agents or pathogens is critical for the threat assessment. Specifically, endemic and epidemic-prone diseases (and their seasonality), the history of recent outbreaks and the communicable disease control programmes operating in the area must be considered. Indicators, such as those used to quantify burden of disease or programmatic impact, are also assessed (*Annex 1*). Environmental factors, such as shelter (amount, quality, location), availability of safe water and sanitation and access to basic health care services, can also strongly influence communicable disease transmission.

The third step, **risk characterization**, uses a risk assessment matrix to analyse the available information on hazard and exposure for each disease under consideration (*Annex 2*). Both aspects of risk – the potential magnitude of the health impact and the likelihood of the event occurring – are approximately quantified and the overall risk is then characterized using the matrix. Based on the overall risk assessment, interventions for disease control are prioritized by evaluating additional factors such as cost, technology, availability and infrastructure requirements

Table 1. Three-step communicable disease risk assessment framework

Step	Main qualitative assessment(s)
STEP 1 Event description	• Type of humanitarian emergency: conflict or natural disaster (flooding disaster, earthquake, tsunami) • Characteristics of population displacement (size, duration, location, demographics, etc.)
STEP 2 Threat/vulnerability assessment (host, agent, environment)	**Host:** • Underlying malnutrition rates • Immunization coverage (e.g. measles, polio) • Community practices (e.g. use of bednets, boiling of drinking-water) • Community cultural practices (e.g. ritual slaughtering practices) • Availability of food **Agent:** • Endemic diseases present (e.g. malaria, Rift Valley fever) • Epidemic-prone diseases and recent epidemics (e.g. cholera, typhoid, meningococcal disease) • Ongoing communicable disease control efforts • Disease incidence, prevalence, seasonality (e.g. dengue, Japanese encephalitis, malaria) **Environment:** • Amount, quality and location of shelter • Availability of safe water and sanitation • Thermal extremes • Secondary toxic exposures • Available infrastructure for health and social services; access to basic primary health care services • Presence of vectors (and potential for proliferation)
STEP 3 Risk characterization	• Integration of information collected in Steps 1 and 2 into risk assessment matrix to estimate overall risk to population based the magnitude of potential impact and likelihood of a disease occurring using a risk assessment matrix (Annex 2) Very high: +++ High: ++ Low: + None: – No information available: N

The outcome is a concise, timely and population-specific profile of projected communicable disease risk, allowing evidence-based decision-making and focusing relief efforts on critical immediate actions. The event-specific technical note is entitled *Communicable disease risk assessment and interventions*. Using this mechanism, risk assessments have been performed for the Horn of Africa flooding disaster (*9*), the Middle East crisis (*10*) and the Indonesia earthquake (*11*) in 2006, and for the severe food shortage in Niger (*12*), the South Asian earthquake (*13*) and the Asian tsunami in 2005 (*14*).

The CD-WGE mechanism focuses WHO technical capacity on reducing the risk and impact of communicable diseases on emergency-affected populations. The risk assessment framework used by the Working Group can inform the prioritization of interventions, identify priority diseases to guide surveillance and early warning strategies, inform health policies and ultimately improve the quality of data available for the ongoing protection of populations affected by humanitarian emergencies.

4. References

1. Connolly MA et al. Communicable diseases in complex emergencies: impacts and challenges. *Lancet*, 2004, 3(364):1974–1983.

2. Connolly MA, Heymann DL. Deadly comrades: war and infectious diseases. *Lancet*, 2002, 360:23–24.

3. Watson JT, Gayer M, Connolly MA. Epidemics after natural disasters. *Emerging Infectious Diseases*, 2007, 13:1–5.

4. Goma Epidemiology Group. Public health impact of Rwandan refugee crisis: what happened in Goma, Zaire, in July 1994? *Lancet*, 1995, 11(345):339–344.

5. Aggarwal R, Krawczynski K. Hepatitis E: an overview and recent advances in clinical and laboratory research. *Journal of Gastroenterology and Hepatology*, 2000, 15:9–20.

6. *Malaria control in complex emergencies: an interagency field handbook.* Geneva, World Health Organization, 2005.

7. Caulfield LE et al. Undernutrition as an underlying cause of child deaths associated with diarrhea, pneumonia, malaria, and measles. *American Journal of Clinical Nutrition*, 2004, 80:193–198.

8. National Research Council. *Risk assessment in the federal government: managing the process.* Washington, DC, National Academy Press, 1983.

9. *Communicable disease risk assessment and interventions. Flooding disaster: Horn of Africa, December 2006*. Geneva, World Health Organization, 2006 (WHO/CDS/NTD/DCE/2006.9; available from: http://www.who.int/diseasecontrol_emergencies/guidelines/flooding_hoa_3.pdf).

10. *Guidelines for disease surveillance/early warning and response: Middle East crisis, August 2006*. Geneva, World Health Organization, 2006 (WHO/CDS/NTD/DCE/2006.6; available from: http://www.who.int/diseasecontrol_emergencies/guidelines/Middle%20East%20Crisis_WHO%20CD%20surveillance_early%20warning%20guidelines.pdf).

11. *Indonesia earthquake-affected areas. Communicable disease risks and interventions, May 2006*. Geneva, World Health Organization, 2006 (WHO/CDS/NTD/DCE/2006.3; available from: http://www.who.int/diseasecontrol_emergencies/guidelines/Indonesia_post_earthquake_2.pdf).

12. *Niger: communicable diseases risk assessment, July 2005*. Geneva, World Health Organization (available from: http://www.who.int/diseasecontrol_emergencies/guidelines/Niger_risk_assessment.pdf).

13. *South Asia earthquake-affected areas, 2005: operational plan and communicable diseases surveillance/early warning and response guidelines*. Geneva, World Health Organization, 2005 (available from: http://www.who.int/diseasecontrol_emergencies/guidelines/asia_earthquake_early_warning.pdf).

14.*Tsunami affected areas, 2005: communicable disease risks and interventions*. Geneva, World Health Organization, 2005 (WHO/CDS/2005.34; available from: http://www.who.int/diseasecontrol_emergencies/guidelines/tsunami_risk_assessment.pdf).

Annex 1. Indicators to define potential hazard for selected diseases

Malaria

- Estimated population at risk
- Estimated population under 5 years of age at risk
- Estimated pregnant women at risk
- Reported malaria cases by year
- Reported malaria cases in children under five years of age by year
- Reported deaths attributed to malaria by year
- Estimated malaria deaths per year
- Estimated malaria incidence per 1000 population at risk per year
- Estimated malaria prevalence
- Population coverage, Insecticide-treated bednets/ indoor spraying of residual insecticide
- Resistance to anti-malarial drugs
- Resistance to insecticides

Measles

- Number of cases reported annually
- Immunization coverage (%), by year

Meningococcal disease

- Cases and deaths reported, by year
- Recent epidemics and serogroups involved

Yellow fever

- Cases and deaths reported, by year
- Recent epidemics
- Estimated vaccine coverage (%)

Poliomyelitis

- Cases and deaths reported, by year
- Recent epidemics
- Estimated vaccine coverage (%)

HIV/AIDS

- Estimated number living with HIV/AIDS, by age and gender
- HIV seroprevalence among ANC attendees
- Estimated adult prevalence rate
- Estimated number in need of ARV, including % children
- Estimated number receiving ARV, including % children
- National ARV regimen
- Prevalence of HIV among adults with TB

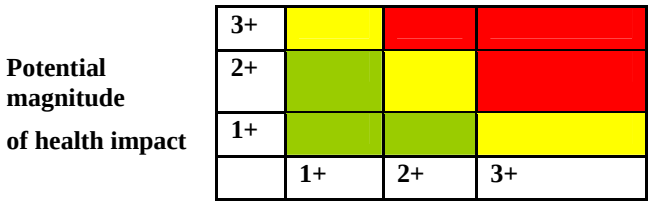
Tuberculosis

- Number of TB cases notified, by year
- Case notification rates per 100,000, by year
- Number of new smear-positive cases, by year
- Rate of new smear-positive cases per 100,000, by year
- Monitoring indicators, for DOTS: new cases and re-treatment cases
    - Number of cases notified
    - Number of cases registered
    - % cured
    - % completed treatment
    - % died
    - % failed
    - % default
    - % success

Malnutrition

- Estimated size of at-risk population
- Prevalence of moderate malnutrition (% of children with weight/height ratio of <-2 and >-3 Z-Scores)
- Prevalence of severe malnutrition (% of children with weight/height ratio less than -3 Z-Scores)

Annex 2. Risk assessment matrix



Low risk	
High risk	
Very high risk	

Potential magnitude of health impact

Severe (3+)	High morbidity/mortality
Moderate (2+)	Excessive morbidity/mortality
Low (1+)	Minimal morbidity/mortality

Likelihood of epidemic occurring

High (3+)	Endemic disease with potential for epidemic transmission clearly present; Widespread exacerbation of conditions favourable for communicable disease transmission; Highly susceptible population
Moderate (2+)	Endemic disease with potential for epidemic transmission present; Some exacerbation of conditions favourable for communicable disease transmission; High background levels of immunity but large number of susceptible people
Low (1+)	Endemic disease with potential for epidemic transmission possibly present; Conditions favourable for communicable disease transmission possibly present; Population largely immune