# Chapter 2.1

## Using Epidemiological Principles to Assess Impacts of Emergencies and Disaster

Thomas D. Waite
Virginia Murray

# Learning objectives

To understand how data can be gathered for epidemiological research in emergencies and disasters in order to assess risk factors and health consequences, including:

- Sources of vulnerability and exposures to hazards.
- Impacts of disasters on mortality and morbidity.
- Sources of data and databases that are available for epidemiological research.
- Value of surveillance mechanisms for epidemiological studies of disasters.

# Introduction (1)

**Epidemiological studies:**

- Investigate the distribution and determinants of health.
- Identify ways to prevent, control or mitigate (the effects of) disease.

**Epidemiological principles:**

- Are used to study the determinants and effects of disasters on humans.
- Provide evidence for effective health emergency and disaster risk management (Health EDRM).
- Assess the adverse health effects of disasters.
- Analyze the risk factors and capacities to manage risks.

# Introduction (2)

**Three main objectives of disaster epidemiology:**

- Prevent or reduce the number of deaths, illnesses, and injuries caused by disasters.
- Provide timely and accurate health information to improve risk assessments, prevention, mitigation, preparedness, response and recovery strategies.
- Provide a body of evidence on the health impacts of disasters to support research and evaluations.

**Key techniques for disaster epidemiologists:**

- Assessments of need.
- Health surveillance.
- Use of registries of affected individuals.
- Assessment of outbreaks and other cascading hazards.

# Rapid needs assessments

- Rapid needs assessments use surveys and population sampling to determine the health and needs of people affected by sudden-impact disasters.
- It is important to ensure that the population sampled is representative of the wider population.
- Using epidemiological methods can help prevent relying on limited or unreliable data.
- Rapid needs assessments are used to collate whatever data are available.

# Rapid needs assessments: MIRA

**Multi-Cluster/Sector Initial Rapid Assessment (MIRA):**

- A survey tool for gathering epidemiological research data.
- Addresses issue of conflicting findings from different needs assessments.
- Provides a foundation of information about the affected population and their needs.

MIRA can be used to identify information sources, through:

- Systematic collation and analysis of secondary data.
- Community level assessment.
- Collation and analysis of data and information using an agreed structure.

# Health and health facility surveillance

**Public health surveillance:**

- Systematic collection, analysis and interpretation of health-related data.
- Uses data for the planning, implementation and evaluation of public health practice.
- Serves as an early warning system and targets response efforts.
- Tracks the impact of an intervention and the extent of health problems.
- Helps set priorities and implement public health policies and strategies.

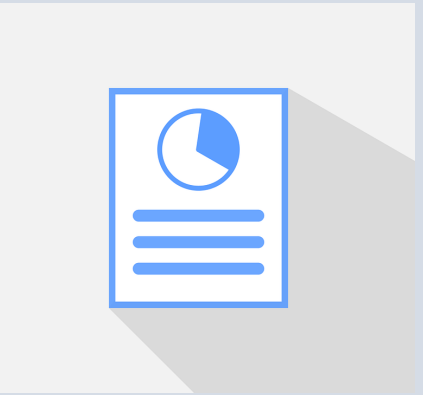
# **Case study:** *Minamata Bay and organic mercury poisoning*

- An estimated 27 tons of mercury were released into Minamata Bay between 1932 and 1968.
- At first, reports of poisoning involved just animals.
- By the mid-1950s, humans showed symptoms of poisoning, including loss of fine motor control, stumbling while walking and violent tremors.
- Epidemiological techniques such as **surveys, case interviews** and **descriptive and analytical epidemiological studies** found a link between the poisoning and consumption of contaminated fish.
- In 1959, organic mercury was found to be the cause of these issues.
- This led to the **Minamata Convention on Mercury**, a global treaty that seeks to protect human health and the environment from mercury.

# Outbreak investigation and other incident reports (1)

Epidemiological methods are also used to investigate disease outbreaks (using descriptive and analytical techniques). This helps to:

- Understand the disease source, how it spreads, how to control it, and what interventions to use.
- Assess the prevalence of biological and pathogenic hazards and test the association between hazards and health outcomes.



# Outbreak investigation and other incident reports (2)

Epidemiological methods can also be used during disasters caused by natural hazards where certain circumstances lead to the rapid spread of infectious diseases:

- Exposure data are used to determine the presence of risk factors and assess the effectiveness of an intervention.

Some investigations happen long after the disaster has occurred because the health impacts, and research needed to investigate them take time to identify.

# Databases holding disaster data (1)

Disaster databases are available for epidemiological research to use data from. Challenges in the use of these databases, which make it difficult to come to a consensus on the range and magnitude of impacts include:

- Lack of standardization in how data are collected and defined.
- Absence of a reliable source of verified data.
- Hosted by a variety of organizations.
- Difficult to compare outputs across databases.
- Lack of shared focus.

# Databases holding disaster data (2)

Two main disaster databases are:

- **CRED and EM-DAT (Emergency Events Database):**
- **DesInventar: A Disaster Loss Database**

**Sendai Framework Monitor:**

- A management tool that helps countries document their disasters to help determine which disaster risk reduction strategies to use.
- Helps inform policy decisions and the allocation of resources.
- Is a major outcome of the **Sendai Framework for Disaster Risk Reduction**.

# Value of disaster epidemiology for research

- Epidemiological research can generate knowledge, fill evidence gaps and identify further gaps long after a disaster has occurred.
- Initial needs assessments, surveillance and incident investigations can be used to inform later strategies for knowledge generation.
- Researchers can limit research waste by using existing data, such as from surveillance systems or disaster databases.
- Partnerships between researchers and responding agencies, academic institutions, governments, etc. can highlight the importance of using existing data.

# Conclusions

- Public health research is essential for determining and understanding health impacts from disasters and other emergencies (see chapter 2.2).
- Epidemiological research provides evidence to help decision-makers plan for future disasters.
- Key epidemiological techniques include assessments of need, health surveillance, registries of affected populations, new studies on outbreaks and other cascading hazards.
- Tools such as MIRA and the WHO's **Early Warning , Alert and Response System** (EWARS) can contribute to reliable research in Health EDRM.

# Key messages

- Epidemiology principles are critical to understanding risk factors and health impacts of disasters and informing strategies for Health EDRM.
- Disaster databases are important sources of data but have limitations that need to be recognized by researchers and the Sendai Framework Monitor may help overcome some of these problems.
- Health impacts of disasters can be immediate and long-term. Long-term impact has been relatively under-studied and the burden on a population is likely to be underestimated and inadequately addressed.

# Further readings

Community Assessment for Public Health Emergency Response (CASPER). Centers for Disease Control and Prevention. 2016. www.cdc.gov/nceh/hsb/disaster/casper/default.htm

Website providing information on the Community Assessment for Public Health Emergency Response (CASPER) toolkit in English and Spanish.

Disaster epidemiology. Centers for Disease Control and Prevention. 2019. www.cdc.gov/nceh/hsb/disaster/epidemiology.htm

Website providing information on disaster epidemiology and response during disasters.

Emergency Handbook. UNHCR. 2019. emergency.unhcr.org/entry/50179/ multicluster-sector-initial-rapid-needs-assessment-mira

Website containing a book chapter describing the conduct of a MIRA.

Global Outbreak Alert and Response Network (GOARN). WHO. extranet.who.int/goarn

Website providing information on international network that responds to emerging epidemics.

Sendai Framework for Disaster Risk Reduction 2015-2030. UNISDR. 2017. www.unisdr.org/we/inform/publications/43291

Website providing information on, and access to, the Sendai Framework for Disaster Risk Reduction 2015-2030.

# References

**This chapter:** Waite T, Murray V. Chapter 2.1: Using epidemiological principles to assess impacts of emergencies and disasters

**Multi-Cluster/Sector Initial Rapid Assessment (MIRA):** IASC. www.unocha.org/sites/dms/Documents/mira_ final_version2012.pdf

**EWARS: a simple, robust system to detect disease outbreaks:** WHO. 2019. https://www.who.int/emergencies/kits/ewars/en

**Case Study: Minamata Bay and organic mercury poisoning:** Lancet.2006; 367: 99–100; and Late Lessons from Early Warnings: Science, Precaution, Innovation, European Environment Agency, Copenhagen, Denmark. 2013. www.eea.europa.eu/publications/late-lessons-2

# Contact information

Virginia Murray
Head of Global Disaster Risk Reduction
UK Health Security Agency
Virginia.Murray@UKHSA.Gov.UK

Health EDRM Research Network Secretariat
WHO Centre for Health Development (WHO Kobe Centre)
**Email**
wkc_tprn@who.int