

# 3.2 Disaster risk factors: hazards, exposure and vulnerability

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# Learning objectives

Understand the key factors to consider when developing a study to assess risk factors relevant to health emergency and disaster risk management (Health EDRM), including:

- How hazards, exposure, and vulnerability/capacity create disaster risk.
- The unique challenges of defining, identifying and measuring risk in disaster research.
- Common issues of validity and quality in causal research in disasters.
- How to conduct a study to assess disaster risk factors.

# Researching risk

- Risks: factors that are associated with an adverse outcome.
- Want to explain the relationship between exposure to risk and a health outcome.
- But. choosing and measuring risk factors in disasters can be a challenge.
- Three main areas of disaster risk: hazards, exposure and vulnerability.

# Hazards

- Hazard: a process, phenomenon or human activity that may cause loss of life, injury or other health impacts; property damage; social and economic disruption or environmental degradation.
- Many ways to classify hazards: natural, biological, technological...
- Characteristics of the hazard, such as timing, scale, severity and frequency can change the risk.
- Risk from hazards are relative to the population that is exposed.

## **Case study:** *Structural risks: Earthquakes and low-strength masonry in Nepal*

22,000 injured and 8800 killed during the 2015 Nepal earthquake.

Buildings made with low-strength masonry were more like to be damaged.

Led to training, certification and capacity building to improve structures for earthquakes.



# HAZARD DEFINITION & CLASSIFICATION REVIEW

TECHNICAL REPORT



# UNDRR

UN Office for Disaster Risk Reduction



**International  
Science Council**

## UNDRR / ISC Sendai Hazard Definition and Classification Review TECHNICAL REPORT 29 July 2020

Supplement of Hazard Information  
Profiles to be published in 2021

<https://council.science/publications/hazards/>  
<https://www.undrr.org/publications>

# Exposure

- Exposure to hazards can negatively affect health.
- *Direct effect* – exposure to the hazard affects health.
- *Indirect effect* – consequences of exposure to hazard over time can cause unsafe or unhealth conditions
- Major challenge for disaster research: who has been affected and when?

## **Case study:** *Changing organizational behavior to reduce exposure risk: Vaccination to prevent congenital rubella syndrome*

In 1941, an ophthalmologist connected an increase in the number of infants with congenital eye problems to an epidemic of rubella.

Review of patient records found that pregnant women who had rubella were more likely to have infants with congenital eye problems.

Showed the connection between prenatal exposure to rubella and birth defects.





## **Case study:** *Changing organizational behavior to reduce exposure risk: Vaccination to prevent congenital rubella syndrome*

- Discovery led to more countries including rubella in national immunization programs.
- By 2009, 130 of 194 WHO Member States included rubella in immunization programs.
- Rubella control and surveillance has improved.

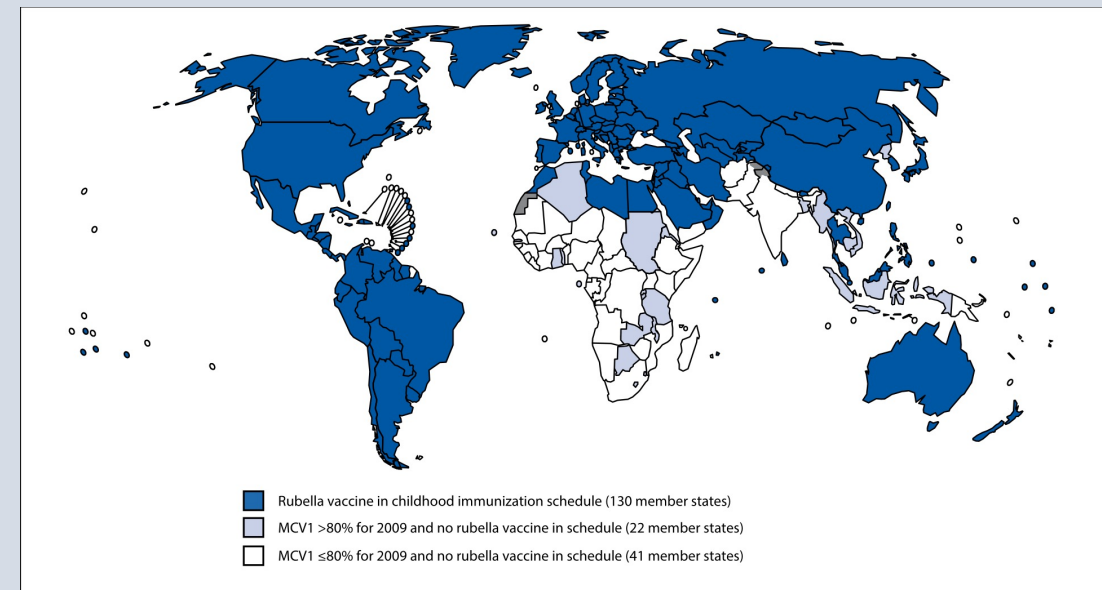


Figure 1: Countries using rubella vaccine and countries meeting WHO criteria for rubella vaccine introduction, 2009. Source: CDC, 2010<sup>9</sup>.

# Vulnerability

- Vulnerability: individual or societal characteristics or circumstances that make a person or community susceptible to the damaging effects of a hazard.
- Highly dependent on context such as burden of disease, governance, geography, etc.
- Vulnerability is a risk factor *and* an outcome of disasters.

## **Case study:** *Individual vulnerability as a health risk: Cold weather impacts and social determinants of health*

- Cold weather increases the risk of respiratory infections, stroke, heart attack and hypothermia..
- Preventing cold-related morbidity and mortality needs interventions to reduce vulnerability.
- Health status, knowing what to do during cold weather, awareness of personal vulnerability, housing quality, heating costs, social networks, medical support and health costs are all associated with vulnerability to cold weather.



## **Case study:** *Changing organizational behavior to reduce exposure risk: Vaccination to prevent congenital rubella syndrome*

- Opportunities to reduce vulnerability include knowledge sharing, advice from professionals, financial incentives to improve insulation, heating subsidies and improving social safety nets for older people.
- The evidence has informed policy and practice to reduce vulnerability of older people, such as UK 'Keep Warm, Keep Well' initiative.



# Determining and measuring risk factors (1)

- Causal studies are prone to issues of *internal validity* – the extent to which the study can answer the research question.
- Typical experimental methods are difficult or impossible to apply in disaster risk factor studies because they would need to expose population to potentially harmful hazards.
- Difficult to control who is exposed and to identify an appropriate control group.
- Need to consider differences in risk between exposed and unexposed groups.

## Determining and measuring risk factors (2)

- Secondary data can be useful but certain groups may not show up in the dataset – researchers need to think about who is missing.
- Risk factors depend on the context and the outcome and there must be a logical link between them.
- Need to understand the relationship between the risk and the outcome in order to measure it – what assumptions are made?

## Determining and measuring risk factors (3)

- Some risk factors can be measured directly, others are subjective.
- Recall accuracy about exposure and risk can be poor.
- Tools should be piloted or validated in the study context beforehand.
- Definitions and measurements used in the study should be clearly stated.
- Any biases in the study should be acknowledged and the setting needs to be understood when applying the findings to other situations.

# Key messages

- Disasters are a combination of hazards, exposure and vulnerability. Finding causative factors for disaster outcomes means examining risk factors in these areas.
- Risk factors can combine in unpredictable ways, creating a complex and unique research context. While it can be difficult, this complexity must be grasped and acknowledged if research is to be valid.
- When designing, conducting and using research, careful scrutiny of the definitions, measurements and risk factors used is important to understand what conclusions can be drawn.



## Further readings

Aschengrau A, Seage GR, editors. *Essentials of Epidemiology in Public Health* (3rd edition). Sudbury, Mass: Jones and Bartlett Publishers. 2008.

Textbook that describes the basic principles of epidemiologic research, including descriptions of causal studies and risk factors, that can be helpful when designing a study.

Kelman I. Lost for words amongst disaster risk science vocabulary? *International Journal of Disaster Risk Science*. 2018; 9(3): 281-91.

A discussion of terms used in this chapter that illustrates the complexity of defining and measuring risk factors and disasters.

Vandenbroucke JP, et al. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): explanation and elaboration. *PLoS Medicine*. 2007; 4(10): e297.

Guidance for reporting observational research studies, with a checklist which can be a useful reminder of important elements when designing a study of associations between risk factors and health outcomes.

# References

**This chapter:** Saulnier DD, Dixit AM, Nunes AR, Murray V. Chapter 3.2: Disaster risk factors – hazards, exposure and vulnerability

**Nepal earthquake case study:**

[https://www.npc.gov.np/images/category/PDNA\\_volume\\_BFinalVersion.pdf](https://www.npc.gov.np/images/category/PDNA_volume_BFinalVersion.pdf)

**Evidence behind cold weather case study:** International Journal of Environmental Health Research;2019;5:1-18.

**Congenital rubella case study:**

[https://www.preventionweb.net/files/32609\\_stagreport2013assembled.pdf](https://www.preventionweb.net/files/32609_stagreport2013assembled.pdf)

**Defining disaster-related health risks:** Prehospital and Disaster Medicine 2018;33:308-16.

**Guide on using research evidence in the humanitarian sector:**

[https://researchonline.lshtm.ac.uk/id/eprint/4649966/1/Blanchet\\_etal\\_2018\\_Research%20Evidence%20in.pdf](https://researchonline.lshtm.ac.uk/id/eprint/4649966/1/Blanchet_etal_2018_Research%20Evidence%20in.pdf)

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