
HANDBOOK OF DISASTER AND EMERGENCY MANAGEMENT

New Era, New Challenges

Second Edition

Edited by

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Krzysztof Goniewicz

Attila J. Hertelendy

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Handbook of Disaster and Emergency Management

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Second Edition

DEDICATED TO



Frederick "Skip" M. Burkle, Jr.

Frederick "Skip" M. Burkle, Jr. was born in New Haven, CT. He attended Notre Dame High School in West Haven, CT, and obtained his bachelor's degree from Saint Michael's College in 1961. He was conferred an honorary doctorate by Saint Michael's College in 2009. He completed his M.D. at the University of Vermont in 1965. He was in his residency in pediatrics (completed 1968) at the Yale School of Medicine when he was drafted into the U.S. Navy. He subsequently completed a fellowship in adolescent medicine in 1970 at Harvard Medical School and a residency in psychiatry in 1974 at the Dartmouth-Hitchcock Medical Center. He obtained an M.P.H. at the University of California at Berkeley in 1975, a Diploma in Emergencies in Large Populations at the University of Geneva in 1989, and a Diploma in Tropical Medicine from the Royal College of Surgeons in Ireland. He has been qualified in Emergency Medicine, Pediatrics, Pediatric emergency medicine, and Psychiatry, and is a Fellow of the American College of Emergency Physicians and the American Academy of Pediatrics. He has inspired hundreds of physicians and other health professionals, attracting many of them into the field of public health emergencies. He has published hundreds of papers within the fields of emergency medicine, disaster medicine and public health and been followed by both younger and older generations of medical professionals.

We dedicate this book to Frederick "Skip" M. Burkle, Jr., or as we call him "Uncle", for his achievements and significant work within the field of medicine and for being a role model to many of us.

Thank you uncle!

*Adam's sons are body limbs, to say;
For they're created of the same clay
Should one organ be troubled by pain
Others would suffer severe strain
Thou, careless of people's suffering
Deserve not the name, "human being"*

From Saadi Shirazi

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PREFACE

Disasters and public health emergencies are increasing. Climate change, transportation incidents, increasing numbers of mass gatherings, chemical and technical incidents, increasing number of armed conflicts and terrorism are some of the major reasons for this increasing pattern. Any of these events may result in severe casualties, destruction of infrastructures and create a situation in which the number of victims may exceed available resources. Much of the knowledge in disaster medicine is based on the “lessons learned”.

However, it has been proven that no lessons learned theoretically can be of practical use if the knowledge is not tested in an appropriate environment. In this perspective, the major clinical excellence and testing laboratories for disaster response are the scenes where disasters happen. Yet, most of the research and reports in the field are produced in high-income countries, while most of the disasters happen in middle- or low-income countries. There is thus a need to bring these two environments together in order to translate theory into practice and among people who are highly exposed and involved in the multidisciplinary management of a disaster or major incident.

Why the second edition

This book was initially produced for an academic program in which the theoretical knowledge was mixed with practical exercises in an environment that allowed mistakes and repetitive learning. However, since 2017, when the first edition of this book was accessible, scholars and managers from diverse countries have welcomed it as a handbook to be used in practice and in the academic setting. Consequently, a need emerged to produce a second edition that is more adjusted to both practical and academic use and not related to any specific program. We have received support from several internationally known academics and field workers, who have contributed to produce the expanded version of the second edition. The topics included are based on research published in the literature, and new topics have been added based on the feedback received after publishing the first edition.

The goal of this publication

Our goal is to offer an easy to read and accessible book in a digital format for all professionals involved in the management of disasters and major incidents. This book is not intended as a substitute for reference books in disaster medicine but should be seen as a primary introduction to the subject. We would like to thank all our co-authors for their excellent and voluntary work and the time they put into this book. Many thanks also go to the authors who contributed to the first edition of the book and paved the way for continuous development of this handbook.

External review

Two independent external reviewers evaluated the books content; readability and relevance. Editors would like to extend their gratitude and sincere thanks to the external reviewers for their thorough review of the book. Many thanks to;

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25 September 2021

Amir Khorram-Manesh, Krzysztof Goniewicz, Attila J. Hertelendy, and Maxim A. Dulebenets

ABBREVIATIONS

ACF

ACLS

AHA (ASEAN)

ALS

ATLS

ASEAN

ADPC

ACMM

AusAid

API

Alternate Care Facility

Advanced Cardiac Life Support

Association of South East Asian Nations (ASEAN) Coordinating Centre for Humanitarian Assistance on Disaster Management - AHA Centre

Advanced Life Support

Advanced Trauma Life Support

Association of South East Asian Nations

Asian Disaster Preparedness Center

ASEAN Center of Military Medicine

Australian Aid

Active Pharmaceutical Ingredients

BLS

Basic Life Support

CAP

CB

CBRNE

CCA

CDC

CECIS

CEDM

CERF

CIMIC/CMC

CNS

CARE

COVID-19

COD

CPM

CTM

Computer Assisted Publishing

Cell Broadcast

Chemical Biological Radiological Nuclear Explosive

Climate Change Adaptation

Centers for Disease Control and Prevention

Common Emergency Communication and Information System

Center for Excellence in Disaster Management

Central Emergency Response Fund

Civilian Military Collaboration

Central Nervous System

Cooperative for Assistance and Relief Everywhere

Coronavirus Disease

Common and Fundamental Operational Datasets

Civil Protection Mechanism

Counter Terrorism Medicine

DG

DHA

DIPECHO

DRKMC

DR

DRM

DRR

Dangerous Goods

Department of Humanitarian Affairs

Disaster Preparedness ECHO

Disaster Risk Management Knowledge Centre

Disaster Response

Disaster Risk Management

Disaster Risk Reduction

EAS

ECHO

EMS

ERCC

EQF

ERC

ESO

EU

European Astronomical Society

European Civil Protection and Humanitarian aid Operations

Emergency Medicine Services

Emergency Response Coordination Centre

European Qualification Framework

European Response Center

Emergency Service Organizations

European Union

EMC	European Medical Corps
EUCPM	European Union Civil Protection Mechanism (EUCPM)
EWS	Early Warning Systems
FAO	Food and Agriculture Organization
FSC	Flexible Surge Capacity
GAD	Generalized Anxiety Disorder
GDACS	Global Disaster Alert and Coordination System
GFMS	Global Flood Monitoring System
GIS	Geographical Information System
GNSS	Global Navigation Satellite System
GO	Governmental Organization
GPS	Geographical Positioning System
HAZMAT	Hazardous Material
HCF	Health Care Facilities
HEMB	Health Emergency Management Bureau
HRO	High Reliability Organization
IAC	Information and Advice Centers
IASC	Inter-Agency Standing Committee
ICRC	International Committee of the Red Cross and Red Crescent Societies
ICRC	International Committee for Red Cross
ICS	Incident Command System
IDP	Internally Displaced Persons
IDRL	International Disaster Response Laws
IFRC	International Federation of Red Cross and Red Crescent Societies
IHL	International Humanitarian Law
INSARG	International Search and Rescue Advisory Group
IOM	International Organization for Migration
IRIN	Integrated Regional Information Networks
ISDR	International Strategy for Disaster Reduction
ISTSS	International Society for Traumatic Stress Studies
JICA	Japan International Cooperation Agency
JEU	Joint European Unit
MI	Major Incident
MIC	Monitoring and Information Centre
MID	Major Incident or Disaster
MMRS	Metropolitan Medical Response System
MODIS	Moderate Resolution Imaging
MRO	Mass Rescue Operation
MSF	Médecins sans Frontières
NATO	North Atlantic Treaty Organization
NDRRMC	National Disaster Risk Reduction and Management Council

NGO	Non-Governmental Organization
NIMS	National Incident Management System
NRP	National Response Plan
OCHA	Office for the Coordination of Humanitarian Affairs
OHCHR	Office of United Nations High Commissioner for Human Rights
OSOCC	On-site Operations Coordination Centers
OXFAM	Oxford Committee for Famine Relief
PIC	Police Incident Commander
PDC	Post-Disaster Complications
PFA	Psychological First Aid
PPE	Personal Protective Equipment
PTSD	Post-Traumatic Stress Disorder
RCC	Regional Command Center
RIC	Rescue Incident Commander
SAR	Search and Rescue
SC	Surge Capacity
SELA	Sistema Económico Latinoamericano y del Caribe (Latin American and Caribbean Economic System)
TTP	Techniques, Tactics, and Procedures
UAS	Unmanned Aerial System
UAV	Unmanned Aerial Vehicles
UN	United Nations
UNDAC	UN Disaster Assessment and Coordination
UNDRC	United Nations Disaster Relief Coordinator
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNHCR	United Nations High Commission for Refugees
UNICEF	United Nations Children's Emergency Fund
UNISDR	United Nations International Strategy for Disaster Reduction
USAID	United States Aid
USAR	Urban Search & Rescue
VSAT	Very Small Aperture Terminal
WFP	World Food Program
WHO	World Health Organization
WPA	World Psychiatric Association

INTRODUCTION

Amir Khorram-Manesh

The management of an increasing number of disasters and public health emergencies aims to minimize the broad consequences of a disaster and demands full preparedness with regard to organizational readiness, communication, and coordination among all partners; resource availability; and professional engagement. Preparedness may be achieved by either being exposed to many disasters or by undergoing proper educational programs. “Acceptable preparedness” is somewhat subjective and what is acceptable may differ due to the geographical and educational background of the countries and their resources, expectations, and quality demands. Furthermore, since disasters occur infrequently, opportunities for frequent exposure to disasters are rare. This necessitates educational initiatives for learning as a part of a comprehensive and standardized management plan and a competency-based educational program (1-2).

Although the majority of nations are actively working to improve their preparedness, published data indicate that the level of preparedness globally is barely acceptable, especially in areas such as hospital preparedness and educational programs. The current coronavirus 2019 pandemic illustrates the significant unpreparedness that all nations experienced and the need for standardization in all management plans, including a more cohesive multiagency involvement. Although standardization may lead to inflexibility due to organizational differences and national legislations, it may ensure quality and uniformity of a syllabus, facilitate international cooperation, and enable evaluation and continuous improvement. A set of minimal standards and evaluation metrics can be achieved through consensus, through education/training, and by using procedures and protocols concerning such key issues as communication, information, and plans (1-3).

In this second edition of the handbook of disaster and emergency management, we have gathered all essential topics that need to be included for a general understanding of the subject. Old chapters have been updated and new chapters were added. We expect that this book facilitates and enhances the intercultural and interagency performance across the Disaster Management (DM) cycle, both with regard to diverse national and cultural backgrounds and different working cultures within diverse agencies. This book does not substitute reference books in disaster and emergency medicine, but rather aims to provide accessible and easy-to-learn information to be combined with the practical aspects of disaster and emergency management.

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Chapter 1

DISASTER: GENERAL PRINCIPLES AND MANAGEMENT

Mahmoudreza Peyravi, Milad Ahmadi Marzaleh, Amir Khorram-Manesh

Summary

Disasters are inevitable, but their impact can be minimized. The management of a disaster is multidisciplinary and follows organized rules and international law. There is a need for mutual understanding based on good communication and agreement on definitions to manage disasters successfully. The aims of this chapter are to point out the general principles of humanitarian action, to describe disaster terminology and crucial element and functions in disaster response, disaster risk identification, management and evaluation.

Introduction

A. Disaster Definition and Classification

A disaster is a sudden devastating event that causes serious disruption of the functioning of a community or a society with widespread human, material, economic and/or environmental losses, which exceed the ability of the affected community or society to cope using its own resources. It is a multifaceted event, open to a range of different interpretations and though often caused by nature, may be man-made. The combination of hazards, vulnerability, and inability to reduce the potential negative consequences of risk results in disaster. Traditionally, disasters caused by nature have been seen as situations that create challenges and problems mainly of a humanitarian nature. However, increasingly, it has come to be recognized, that human rights protection also needs to be provided in these contexts. At least one of the following criteria must be met for a disaster to be entered into the database of the UN's International Strategy for Disaster Reduction (ISDR) (1-4):

- A1) A report of 10 or more people killed,
- A2) A report of 100 people affected,
- A3) A declaration of a state of emergency by the relevant government,
- A4) A request by the national government for international assistance.

The management of an emergency requires a response using the same resources but in a different pace and process, while a disaster requires a response beyond the capacity of the affected community (2-3). A crisis may have numerous definitions. The Center for Disease Control and Prevention (CDC) defines a crisis as “an acute emotional upset; it is manifested in an inability to cope emotionally, cognitively, or behaviorally and to solve problems as usual” (5). Crisis is simply a turning point at which the trend of all future events, especially for better or worse is determined. It presents a cause of instability or danger, in social, economic, political, or international affairs leading to a decisive change (6). Disasters and crises are not connected with certain time or place, but both can happen suddenly and lead to catastrophic situations. Disasters are urgent events that have different impacts according to type and size. A disaster cannot be prevented, but its impact might be mitigated, e.g., floods, fires, etc. Crises, on the other hand, are progressive urgencies that represent a major threat to the interests of the state, are accompanied by high pressures and tensions, and can possibly be ameliorated by negotiations, e.g., airplane highjacking, hostage taking, etc. (7-9).

There are diverse classifications of disasters. One way is to classify them into those caused by nature or humans. Disasters caused by nature consist of three specific groups:

- **Hydro-meteorological** disasters are natural processes or phenomena of atmospheric, hydrological or oceanographic nature that may cause loss of life or injury, property damage, social and economic disruption or environmental degradation. These include floods and wave surges, storms, avalanches, and droughts and related disasters (extreme temperatures and forest/scrub fires).
- **Geophysical** disasters are natural Earth processes or phenomena that may cause loss of life or injury, property damage, social and economic disruption or environmental degradation. These include earthquakes, landslides, and volcanic eruptions.
- **Biological** disasters are processes of organic origin or those conveyed by biological vectors, including exposure to pathogenic microorganisms, toxins, and bioactive substances, which may cause loss of life or injury, property damage, social and economic disruption or environmental degradation. These include epidemics and insect/animal plagues.

Another classification is the one by the United Nations Office for Disaster Risk Reduction, which classifies disasters and crises in a different way and into three types;

- **First:** *Major* disasters such as earthquakes, volcanoes, floods and tremors.
- **Second:** *Visible* disasters such as famine and epidemics.
- **Third:** *Sudden* disasters such as industrial or nuclear disasters or in general those resulting from technological development.

Irrespective of the classification, disasters result in economic and human life losses. The economic impact of a disaster usually consists of direct (e.g., damage to infrastructure, crops, housing) and indirect (e.g., loss of revenues, unemployment, market destabilization) consequences on the local economy. Humans cause technological or manmade disasters (complex emergencies/conflicts, famine, internal displaced populations, refugees, Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE), industrial and transport accidents), intentionally (terrorism) or unintentionally due to negligence. There is also an emerging third type of disasters, which is represented in a complex form of the previous two main types. This type, sometime called “hybrid disaster”, starts with human action but becomes complicated when the nature plays its role in increasing the magnitude of the disaster (9). Negligence in controlling agricultural pests, which leads to damage of agricultural production resulting in severe consequences for the community, or negligence in reviewing electricity connections, which leads to fires in towns and electricity stations that consequently lead to human and material losses, are some of the examples (1-4).

Crises on the other hand can be **Intentional** (planned such as terrorism) crises or **Unintentional** (unplanned such as flooding) crises, **Internal** (caused within the organization) or **External** (caused due to external threats) crises, or classified after their causes (e.g., administrative and technical hazards, general and external trends, external surrounding environment, or nature). Kippenberger lists seven types of crisis that face managers: disasters caused by nature; technological disasters; crises of confrontation between human interests; acts of malevolence; crises due to misplaced management values; acts of deception; and management misconduct (4, 10).

B. General Humanitarian Principles

During the past decades, numerous disasters have affected billions of people, and killed millions, all accompanied by high economic costs. According to UNISDR (11) in 2019 alone, there were 308 reported disasters, with 24,396 people dead and 50 million people affected (12). These reports necessitate humanitarian actions, which aim at saving lives, alleviating suffering and maintaining human dignity during and in the aftermath of manmade crises and disasters caused by nature, as well

as to prevent and strengthen preparedness for the occurrence of such situations (12). The following principles guide all humanitarian actions in disasters: **Humanity**; Saving human lives and alleviating suffering wherever it is found, is central to humanity. **Impartiality**; All actions implement solely based on need, without discrimination between or within affected populations. **Neutrality**; Humanitarian action must not favor any side in an armed conflict or other dispute where such action is carried out. **Independency**; The autonomy of humanitarian objectives from the political, economic, military or other objectives that any actor may hold with regard to areas where humanitarian action is being implemented. It is thus crucial that all organizations commit and undertake the following general principles in their Humanitarian Actions:

1. Respect and promote the implementation of the international humanitarian law, refugee law, and human rights.
2. While reaffirming the primary responsibility of states for the victims of humanitarian emergencies within their own borders, strive to ensure flexible and timely funding, based on the collective obligation of striving to meet humanitarian needs.
3. Allocate humanitarian funding in proportion to needs and based on needs assessments.
4. Request implementing humanitarian organizations to ensure, to the greatest possible extent, the adequate involvement of beneficiaries in the design, implementation, monitoring and evaluation of humanitarian response.
5. Strengthen the capacity of affected countries and local communities to prevent, prepare for, mitigate and respond to humanitarian crises, with the goal of ensuring that governments and local communities are better able to meet their responsibilities and coordinate effectively with humanitarian partners.
6. Provide humanitarian assistance in ways that are supportive of recovery and long-term development, striving to ensure support, where appropriate, to the maintenance and return of sustainable livelihoods and transitions from humanitarian relief to recovery and development activities.
7. Support and promote the central and unique role of the United Nations in providing leadership and coordination of international humanitarian action, the special role of the International Committee of the Red Cross, and the vital role of the United Nations, the International Red Cross and Red Crescent Movement and non-governmental organizations in implementing humanitarian actions.

C. Disaster Cycle

There are different phases in a disaster, which have their own characteristics and challenges. There are rapid effect and slow-effect disasters. Rapid occurring disasters have the following phases (1, 13):

Prevention phase: Includes all measures that aim at preventing human hazards, primarily from potential disasters caused by nature or manmade (both physical and biological) attacks. However, not all disasters can be prevented and some can be limited or mitigated (14).

Damage-mitigation phase: Includes all procedures conducted before the occurrence of the disaster, as well as preparations that aim to reduce the rate of threats.

Preparedness phase: Includes steps taken to reduce the expected damage, mortality and organizing transportation operations for individuals from threatened positions to other positions.

Response phase: Comes directly after the occurrence of the disaster and includes rescue works, looking for survivors and meeting victims' basic needs.

Recovery phase: Consists of two phases of reconstruction and rehabilitation (1).

- **Rehabilitation phase:** Includes decisions-makings after the occurrence of the disaster, intended to return the population to the pre-disaster state.
- **Reconstruction phase:** Includes implementation of procedures that integrates affected persons from a disaster into a settlement or complete return for the pre-disaster phase after the rehabilitation phase.

Once the recovery phase is complete, steps must be taken for sustainable development (1, 16). Slow disasters include, in addition to the phases of rapid disasters, an early warning phase. Early warning is an important strategy to save lives and reduce damage. However, the magnitude of the task of designing, implementing, and sustaining early warning systems in communities is challenging (17).

D. Disaster Management

Disaster management aims at taking immediate and proper measures to cope with disasters and their components and consequences under time pressure and threat due to looming danger and the lack of adequate and accurate information and other resources. Such actions need to be planned and can be conducted before, during and after disasters strike to cover all phases of a disaster.

- Pre-disaster - warning stage of an impending disaster, prevention, and preparation.
- Disaster response – responding to the acute disaster.
- Post-disaster - recovery or clean-up, lessons learned, sustainable development, etc.

Lack of proper attention and failure to draft strategic plans for managing disasters in a scientific way might lead to a situation that can lead to the destruction of institutions and systems. Disaster management and prevention differ according to the type and size of the disaster as well as degree of its severity. Planning should include strategic planning, defining specific objectives, strategic analysis of the environment, using prediction tools related to the type of disaster and hazard analysis, coordination of efforts and effective design of organizational structures. Disaster risk can be managed by taking steps that reduce the potential impacts of disasters, such as building dikes and preventing the construction of housing and infrastructure in flood-prone areas (1, 13, 18-19).

Diagnosing a disaster

There are many basic approaches for diagnosing disasters and crises, such as:

- a. **Descriptive and analytical approach:** The phases of a disaster are studied to determine, describe and analyze its features, general characteristics, and consequences.
- b. **Historical approach:** Uses information about any disaster or crisis in a historic perspective to identify the causal factors of the crisis or disaster.
- c. **Systems approach:** Looks into the components of the disaster or crisis as a system and it is based on a set of integrated systems each of which has a role in the occurrence of crisis or disaster.
- d. **Environmental approach:** Considers the crisis or disaster because of its own environment where there are factors that create the climate of crisis or disaster and studies its surrounding environment.
- e. **Case study approach:** Studies each crisis or disaster individually or as an independent case considering that each case is unique in terms of time, place and the subject of the crisis.
- f. **Comparative studies approach:** Compare various disasters and crises to determine the differences among them.
- g. **Integrated studies approach:** Integrates all the above-mentioned approaches in studying crises and disasters. This approach is based on three perspectives upon handling of crises, which are either within the crisis or at its margin or away from it even though the study area is

affected by the crisis. These are:

- Deep analysis and exploration of the causes of the crisis, its reasons, and motives through the phases of its development,
- Wide understanding and overview of the crisis, its extent and influencing elements,
- Forecasting vision that looks forward to anticipate what can occur in terms of subsequent developments besides their risks, size of losses, costs, etc.

Facing a disaster

When facing crises and disasters, people react in two ways. Either they already have a plan how to act or they act spontaneously and completely emotionally. The spontaneous and emotional reaction is situation-based and is expressed in several ways, such as escaping from crisis, jumping over crisis, being submissive and not responding, accepting and surrendering, and finally, bargaining and negotiating (20). However, in reality, all crisis management systems try to implement evidence-based methods, by using the following basic management functions:

- Planning:** Planning refers to the identification of the problem (what), the way it can be resolved (why, how), and considers the facts of the crisis, the changes, prediction of future events, preparation for emergencies and drafting scenarios for effective treatment. Planning as a scientific tool determines handling methods, time, efforts, material and human resources needed for managing crises and disasters before their occurrence. Strategic planning depends on thorough internal and external analysis processes, determination of mission, future vision and strategic policies.
- Organizing:** Organization is necessary for effective management of disasters and crises; coordination that leads to the unification of efforts and integration for handling a crisis. It must have a proper structure that defines individual activities and responsibilities for managing disasters. In addition, it promotes efficient communication.
- Directing:** Official orders (written instruction and approved) are essential to confront the incident directly, rapidly and properly. This process needs knowledge of the available internal capability of the systems including human and material resources. Proper directing utilizes available scientific methods, charts, pictures and diagrams to define tasks as well as explaining their nature, distribution, and interrelationships through meeting involved stakeholders. Success is culture-dependent and not all participants may be familiar with such procedures.
- Controlling:** To follow up directions and to ensure the effective, prompt and complete execution of work tasks. This requires prior control of available resources and their effectiveness, tight control of the activity of crisis teams, determination of limitations, and handling each aspect of deviation from the plan in prior- and post-control.

Strategies for preventing disasters (21-24)

- Developing early warning, information and communication systems.
- Developing community-based strategies for disaster risk management to increase the populations' resilience, especially vulnerable groups (14).
- Developing internal and external coordination (15), and confrontation plans according to priorities in the sources of threat.
- Assembling and storing stocks of medical and food supplies, rescue tools, etc.
- Preparing plans for mobilization of emergency forces, engineering equipment, logistic and communication, volunteers, accommodation centers and disasters management teams.

- Deciding the role of all governmental authorities and relevant ministries concerned with disasters and related to their responsibilities and coordinating their efforts.
- Deciding priorities of confronting disasters in case they are multiple ones in a given area.
- Handling phobic situations related to the disaster via enhancing morale, awareness and proper management of the incident and preventing social unrest.
- Developing a localized incident command system, leading and control, and taking rapid and proper decisions without hesitation or discrepancy in instructions for participating authorities.

These strategies require a systematic approach. **First:** Study and recognize the nature, type, size, potential, and consequences of disasters. **Second:** Preplan for all types of disasters and needed resources, draft relevant legislation, establish regional and international cooperation to control disasters. **Third:** Define the priorities for managing various disasters and estimation of costs.

Necessary elements and functions in disaster management

According to the earlier points, varieties of functions are needed in disaster management. However, since resources and availabilities are different in various countries, these functions may also vary accordingly. Disaster Management aims to organize and manage the available resources and responsibilities throughout mitigation, preparedness, and response and recovery phases of a disaster to lessen the impact of the incident. The following functions can be recommended (2, 25-28).

- **Hazard and Risk Identification, and Management:** This broad area includes the expertise of local, as well as national/international expert teams and the process, which eliminates transfers, reduces or mitigates the effect of hazards (chapter 3).
- **Authorities and Law:** In the case of mass disasters, common laws are often insufficient and/or not applicable. Legal and political aspects of disaster management are discussed in chapters 4 and 5.
- **Resources Management and Planning:** Resource management is one of the most important features in disaster management and requires effective planning, including several steps, which includes hazard identification, risk analysis and hazard prevention, resource identification and allocation in weak spots, detailed disaster operation plan, and strategies for implementation of such a plan. These plans can be nationally, regionally or locally specific due to a large variety of possible scenarios. Furthermore, detailed disaster records are to be maintained in order to develop a good scientific base for later evaluation and re-analysis (chapter 1).
- **Collaboration, Coordination, Command, and Control - Incident Command System:** This function defines the oversight of mass disasters and is discussed in details in chapter 8.
- **Communications:** In mass disasters communication in both vertical and horizontal directions are crucial. Communication is discussed in chapter 11.
- **Warnings and Public Information Management:** General warning/alerting system serves to alert rescue services, important organizations, and government officials as well as the public of the threatening disaster and the correct conduct. Public should be informed and educated to minimize mortality as well as the loss of property and general resources (chapters 9 and 14).
- **Logistics and Facilities:** Includes the necessary facilities and services needed in immediate disaster response and recovery operations (chapter 10).
- **Education and Training of Emergency Personnel:** This function merges all available medical, fire-fighting, police etc. training algorithms into a multidisciplinary training system. It begins with the assessment of the available training programs, followed by their improvement and development

through training models and simulations and of courses on their implementation in specific disasters, and re-evaluation of the programs for potential improvement (25-26, 29). Refer to chapter 30.

- **Education, Training and Exercise of the Population:** This is an important element related to the public information function and public health strategy. It serves to develop and implement public education and information programs, training and exercise opportunities in order to minimize casualty numbers and property losses (22, 30-31). Refer to chapter 14.

- **Administration and Finance:** Regulates administrative and financial procedures in all phases of a disaster, as discussed in chapter 32.

- **Interoperability Service:** An infrastructure with common service functions that enables different automated information systems to “talk to each other.” Disasters hit often several towns/regions. Lack of communication channels between these areas may lead to over/under service. One town/region can suffer little with massive resources and others can suffer much more because of scarce resources. Interoperability service can serve to mitigate these differences (2, 27-28).

- **Mutual Aid:** This vital segment of disaster planning represents pre-incident plans developed and agreed between different jurisdictions for mutual aid in case of overwhelming disasters. It regulates legal aspects, and procedural resources including licensing, liability and compensational issues, work force, and technology in disaster management, and vary from only humanitarian (food, drugs, water, and technical resources) to full medical, as well as military and other human resources help (2, 27-28).

- **Managing Volunteers and Donations:** In many mass disasters, volunteers have been used inadequately and medical/financial donations have been misplaced and even stolen. This function is needed to regulate the recruitment of volunteers, their organization and education, and their correct field deployment in order to maximize the positive effects and minimize negative effects. It may also provide opportunities for training and exercises together with the other agency to achieve the ultimate goal of disaster management, which is reducing deaths and injuries by integrating the action and performance of these groups (31). Donations are directed to a single account/storage facility, deployed from a central command center in order to ensure correct utilization and keep records. To efficiently manage and control these donations, the use of specific protocols and plans should be considered. Indeed, only a single organization should take the full responsibility for the task (32-33).

- **Surge capacity:** Different mass disasters present different challenges for surge capacity, such as a gradual influx of patients in an infectious disease outbreak vs. a massive surge of victims in a terrorist attack (22). Refer to chapter 16.

- **Tactical Emergency Medical Service:** This is a specific function. Conventional emergency medical services are often not prepared for specific mass disaster setting, especially if their own lives are threatened. Good medicine can be bad tactics in the field, and emergency services involved in mass disasters must have the specific tactical training to ensure the best medical care with minimal rescue casualties. Special training courses are already being developed teaching EMS how to perform in, for example, terrorist bombings and similar events (34).

- **Medical Intelligence:** Coordination of emergency management is essential in case of mass disasters. A medical intelligence center gathers information through cooperation and collaboration with other services. This provides a centralized coordination facility, which then improves field coordination between medical and other services. Some towns/regions already have their own centers that can be modified if necessary, but a mobile center can be established in a case of a mass disaster in the area without a center of their own (35).

Incident reporting

The systematic reporting of major incidents has become imperative and aims to develop a global database to facilitate comparative analyses of real-life incidents and field exercises (36). There are several different templates to use for data collection. However, their use has been limited, their feasibility untested and they seem to lack a specific focus on the prehospital phase of major incident management (37). A new consensus-based template, which is easily accessible, focused on the prehospital phase of an incident, revised after feasibility testing, has recently been introduced (38).

Conclusions

Disaster management is complex and its system differs based on each nation's cultural, economic and political characteristics, its risk profile, vulnerability, development or decline of emergency management. Each of these features may be influenced by interaction with agencies and the international disaster management organizations (refer to chapter 7). Disaster management as a practical and professional field is expanding and improving and necessitates the collaboration between the governmental and non-governmental organizations in various stages of disasters and management functions such as command and control, planning, organizing, and coordinating. Proper disaster management requires a thorough and comprehensive understanding of the terminology of disasters.

There are different stages in disaster management following the diverse phases of disasters. The outcomes of each disaster and its management may differ globally due to the type of disasters and local conditions. Nevertheless, all disasters may have similar management principles. Organizing a valid Incident Command System in disaster management is a critical factor that enables coordination and collaboration between different agencies through a valid communication. Risk communication and timely use of available and valid information is necessary in response to a disaster. Valid information can be obtained from local police, fire department, and Emergency Medical Services (EMS). Launching hotlines between individuals and specialized organizations could also be very helpful. Disaster response and management functions should work in concert to enable a greater outcome from all organizational resources and knowledge and in all aspects of disaster management.

To increase the ability of coping a disaster, readiness through seminars, information campaigns, exercise and training are crucial. Training initiatives should be offered to all involved organizations and their staff with a regular frequency (see chapters on training and exercises). When performed continuously, these exercises will be more effective and can help improving the attitude, knowledge, and skills of the staff involved (25-26).

Take-Home Messages

- Efforts to raise awareness and knowledge about disasters help to prepare individuals and the entire society.
- Improving the scientific and practical skills of individuals help to save lives of both victims and participating professionals.
- Corresponding each disaster phase to appropriate management phase will improve disaster management.
- Implementation of all functions needed for disaster organization is mandatory for a successful disaster management.

- Training and exercises in a risk-free environment provide the needed improvement among professional, volunteers and public to achieve a coherent response.

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Chapter 2

GOVERNMENTAL AND NON-GOVERNMENTAL ORGANIZATIONS

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Summary

The consequences of disasters are devastating and varying. Lives are lost, housing, crops, and livelihoods are destroyed. Humanitarian aid to the victims is necessary, ranging from food, clothing, healthcare, shelter, water, and sanitation to emergency repairs of infrastructure, demining actions, psychological support, and education. Several national and international agencies partake in humanitarian aid provision at various levels, making knowledge of their mandate and competencies necessary. Governmental Organizations and Non-Governmental Organizations (GOs and NGOs) aim at helping the communities in need but differ essentially in term of source of funding. Governments fund GOs, while the NGOs rely on private funds. Therefore, NGOs are more independent from politics. Both organizations are, however, important stakeholders in disaster and emergency management. These organizations provide skills and expertise in a number of different fields ranging from the creation of temporary shelters and housing; search and rescue operations; collecting and distribution of food/non-food items; interventions in disaster and public health emergency management and their consequences; and, policy making and capacity building. While GOs are more in charge of policies and coordination of actions than implementation, NGOs are usually more flexible and faster in mobilizing resources, both in terms of personnel and funding, making them more efficient and successful in humanitarian interventions and operations.

Introduction

Disasters are devastating and their consequences take lives and destroy housing, crops, and livelihoods. The provision of humanitarian aids to the victims of disasters and emergencies is necessary in a variety of forms, depending on the nature of the crisis. There are several national and international agencies, which are involved in the provision and delivery of the needed aid. The modern concept of disaster management and Disaster Relief and Humanitarian Intervention consists of many different actors (1). These can be divided into two large categories: Governmental (GO) and Non-Governmental Organizations (NGO). Both of them are usually not for profit organizations but while GO are financed by public funds, usually made available by national or international governments, NGOs depend on private funding, usually donations by private institutions, government grants and individuals. NGOs can access public money in order to implement their field activities but not to run the organization itself. This keeps them independent to some degree from national or international governments. In this chapter, some of the most important and active international GOs and NGOs are described.

A. International Governmental Organizations

1. Association of South East Asian Nations (ASEAN)

1.1 ASEAN Center of Military Medicine (ACMM)

The ASEAN Center of Military Medicine (ACMM) drives regional efforts in pursuing cooperation in the area of military medicine. The Center also develops joint medical response plans, assesses medical

needs in crisis, as well as conducts training courses and researches in emergency medical services to promote practical cooperation among the medical services of the Region's military divisions and add a value to the overall humanitarian assistance and disaster relief framework. The ACMM also complements the work of the ASEAN Coordination Centre for Humanitarian Assistance in improving the Region's response and coordination mechanisms. ACMM is to promote military medical activities in the Region, as well as to support other military cooperation and serve as a tool to promote trusts amongst nations in the Asia-Pacific region (2-3).

1.2 ASEAN Coordinating Centre for Humanitarian Assistance on Disaster Management - AHA Centre

AHA is an inter-governmental organization, established by the ten ASEAN Member States with the aim to facilitate cooperation and coordination of disaster management among these member states. The center primarily works with the ASEAN member States' National Disaster Management Organizations (NDMOs) but also collaborates with international organizations, private sector and civil society organizations, such as the IFRC UN, and Association of Southeast Asian Nations Agreement on Disaster Management and Emergency Response (AADMER) Partnership Group (4-7)

2. AusAID

Australian Aid (AusAID) is the international aid organization of the Australian Government and is a part of the Department of Foreign Affairs and Trade. The objective of AusAID is to help developing countries reduce poverty and achieve sustainable development. It also provides policy advice and support to the Minister and Parliamentary Secretary on development *issues* and plans and coordinates poverty reduction activities in partnership with developing countries (8).

3. European Union (UM)

3.1 European Union Civil Protection Mechanism (EUCPM)

In addition to providing funding to humanitarian aid, ECHO is also in charge of the EU Civil Protection Mechanism (EUCPM). Established in 2001, the Mechanism fosters cooperation among national civil protection authorities across Europe. Currently, 31 countries are members of the Mechanism; all 28 EU Member States in addition to Iceland, Norway, and the FY Republic of Macedonia. The Mechanism was set up to enable coordinated assistance from the participating states to victims of natural and manmade disasters in Europe and elsewhere. All EU Member States are taking part in the EUCPM, a body that can be activated by each Member State (but also by non-member National Authorities) in case of a disaster overwhelming a country's capability to cope. Civil protection assistance consists of in-kind contribution, deployment of specially equipped teams or experts assessing and coordinating support right in the field. Each Member State can register its capacity to contribute in case of a disaster. This contribution takes the form of a module. Types of modules are search and rescue, advanced medical post, water and sanitation, and several others. (9-11)

3.2 European Commission Humanitarian Office (ECHO)

Through its Humanitarian Office, the European Union (EU) provides assistance to the affected countries and populations in all emergencies or disasters, according to four principles grounded in the International Humanitarian Law (EU humanitarian aid) (12):

Humanity, addresses human suffering, with particular attention to the most vulnerable groups of people, while respecting the dignity of all victims.

Neutrality means that it does not favor any side in a conflict.

Impartiality, the aid is provided solely based on needs, without any kind of discrimination.

Independence, it is independent of any agenda, be it political, economic, military or else.

The DG - ECHO (Directorate-General for European Civil Protection and Humanitarian Aid Operations), formerly known as the European Community Humanitarian Aid Office, is the European Commission's department for overseas humanitarian aid and for civil protection. For its humanitarian interventions, ECHO does not implement assistance programs itself but funds operations through a wide range of around 200 partners (NGOs, UN agencies, and international organizations such as the Red Cross/Red Crescent Movement). In 2013, ECHO had 44 field offices in 39 countries, with 149 international humanitarian experts and 315 national staff members. The field offices provide an up-to-date analysis of needs assessment in a given country or region, contribute to the development of intervention strategies and policy development, provide technical support to ECHO funded operations, and ensure adequate monitoring of these interventions and facilitate donor's coordination at field level. ECHO's mandate is to provide emergency assistance and relief (in the form of goods and services) to victims of conflict and natural or manmade disasters outside the EU. Its mandate also extends to disaster prevention and post-crisis operations. In 2007, the European Commission adopted a "European Consensus on Humanitarian Aid" to constitute the first European political text of reference on humanitarian aid. It also stipulates, "Humanitarian aid is not a management tool for crises management". However, amongst others, several NGOs called on the European Union to use its political influence to support humanitarian aid based on the mere principles of neutrality and impartiality and not on security agendas. In 2012, ECHO developed the first revision of the Consensus since its establishment, highlighting a need for stronger partnerships through a quality selection of partners and ensuring enhanced accountability towards citizens and stakeholders. Together with other donors, ECHO worked with the Inter-Agency Standing Committee (IASC) to create the Transformative Agenda. Principles of humanitarian leadership, accountability and coordination were agreed upon to improve the rapidity, efficiency, and effectiveness of humanitarian response.(13-14) The European Consensus on Humanitarian Aid outlines the policy framework for the EU when acting in response to humanitarian crises, aiming to improve coherence, effectiveness, and quality of the humanitarian response. Cooperation with the UN, non-EU donors, NGOs, and communities and local and regional organizations was enhanced by humanitarian aid policies, information sharing and by engagement with international best practices initiatives. (12)

3.3 EU- Emergency Response Coordination Centre (ERCC)

The Emergency Response Coordination Centre (ERCC) is the key organization in coordination between all EU Member States to deliver assistance, expertise, teams and special equipment to affected countries. The center operates 24/7 to ensure tailored needs assistance and avoid duplication of relief efforts. It can liaise directly with the National Civil Protection Authorities of the Country and can help any Country inside or outside the EU affected by a major disaster upon request. The quality criteria and a certification were established to ensure the standard and quality of response. The development of a reserve capacity known as "rescEU reserve" to be used as last resort when Member States' capacities are overwhelmed (15).

3.4 EU- European Medical Corps

The European Medical Corps enables quick medical assistance and public health expertise from all EU Member States and Participating States to a health emergency inside and outside the EU. The European Medical Corps was created in response to the acute shortage of trained medical teams during the Ebola crisis in West Africa in 2014. To date, 11 States party to the Mechanism have committed emergency medical teams and their equipment to the European Medical Corps: Belgium, Estonia, the Czech Republic, Italy, France, Germany, Norway, Portugal, Slovakia, Spain, and Sweden. It continues to coordinate an effective European response in health emergencies under the

EU Civil Protection Mechanism (EUCPM). The EU's Emergency Response Coordination Centre, which is the operational hub of the EU Civil Protection Mechanism, coordinates the deployment. The European Medical Corps gathers all medical response capacities committed by Member States to the European Civil Protection Pool. To become a part of the European Medical Corps, the EU has set up a certification and registration process to make sure they meet high standards, including internationally recognized ones by the World Health Organization (WHO) when they exist. Teams are trained to work alongside colleagues from other countries and according to international guidelines. In return, they benefit from EU financial support. The EU provides grants for upgrading teams to improve. The European Medical Corps is part of the EU's comprehensive approach to health disasters. Recent deployments of the European Medical Corps were in Mozambique (cyclone Idai, March 2019) and in Samoa for Measles Outbreak in December 2019. The EMC has an important component, which they call as Public Health Team (PHT), which aims to provide teams of experts in prevention and control of communicable diseases to support activities in the affected country, under the overall coordination of the national authorities of the affected countries and the WHO. PHTs are expected to have the capacity to be deployed rapidly to assess public health risks and needs related to a health emergency, or to support response operations. PHTs are assembled ad hoc with public health experts from participating countries and European Center for Disease Prevention and Control (ECDC) (16). EMCs have capacities such as (17):

Emergency medical teams (EMT) to provide direct medical care to people affected by a disaster. The World Health Organization (WHO) certifies these teams. In addition, German Red Cross contributed a specialized infectious disease isolation field hospital.

Mobile biosafety laboratories: Belgium has since committed its B-Life Lab (Biological Light Fieldable Laboratory for Emergencies) and Germany has the European Mobile Laboratory, coordinated by the Bernhard-Nocht-Institute for Tropical Medicine, and,

Medical evacuation capacities: which are important for mass casualty disasters requiring the evacuation of EU citizens, and for retrieving humanitarian and medical workers from disaster areas, if needed. Currently, Sweden provides such assets to the European Medical Corps, while Slovakia is in the process of certifying its committed capacity.

4. International Committee of the Red Cross (ICRC)

The ICRC was established in 1863 to help people and victims of war. The ICRC is the largest humanitarian network in the world and consists of the International Committee of the Red Cross, the International Federation of Red Cross and Red Crescent Societies, and 190 individual National Societies. National Societies act as auxiliaries to their national authorities in the humanitarian field to provide various services, including disaster relief, health, and social programs. The ICRC is mainly funded by voluntary donations from governments and from National Red Cross and Red Crescent Societies. The ICRC is an independent and neutral organization; working based on the Geneva Convention of 1949 to ensure humanitarian protection and assistance for victims of war and armed violence. It takes action in response to emergencies and promotes respect for international humanitarian law and its implementation in national law.

The ICRC actions follow seven fundamental principles: 1) humanity, 2) impartiality, 3) neutrality, 4) independence, 5) voluntary service, 6) unity and 7) universality. In operations, its role and responsibility were clarified by the Seville Agreement to enhance coordination and eliminate overlapping efforts. The code of conduct has been developed to coordinate with NGOs in the field (18-19).

5. Japan International Cooperation Agency (JICA)

The Japan International Cooperation Agency (also known as "JICA") is a semi-governmental organization under the jurisdiction of the Ministry of Foreign Affairs and delivers the bulk of Official Development Assistance (ODA) for the government of Japan. It is chartered with assisting economic and social growth in developing countries and the promotion of international cooperation. Since 2008, JICA has become one of the largest bilateral development organizations in the world, with a network of 97 overseas offices, projects in more than 150 countries and available financial resources. The agency is responsible for administering part of Japan's grant aid and three major ODA components: technical cooperation, grant aid and concessional loans. JICA also strengthens research, education and training to achieve the concept of "human security". JICA is part of Japan's official development assistance efforts (e.g., technical assistance programs/projects for capacity and institutional development, feasibility studies, master plans, and dispatch of specialists) which bridge between the people of Japan and developing countries. The Japan Disaster Relief Team is part of JICA's efforts, which was deployed to disaster affected countries worldwide such as the 2005 South Asian earthquake and Typhoon Haiyan. JICA is advancing its activities around the pillars of a field-oriented approach, human security, and enhanced effectiveness, efficiency and speed (20).

6. Latin American and Caribbean Economic System (SELA: Sistema Económico Latinoamericano y del Caribe)

SELA is an intergovernmental regional organization established on October 17, 1975 by the Panama convention. It is primarily promoting a system of consultation and coordination for the Latin American and Caribbean region to adopt common positions and strategies on economic issues fostering cooperation and integration among these nations. It also promotes the commitment of the continent with DRR (Disaster Risk Reduction), through a social responsibility strategy that contributes to ensure conditions of security and development in their communities, and it has become a major regional forum for sharing lessons learned and exchanging best practices based on the lessons learned from previous disasters that the continent has experienced (21).

7. UN (United Nations)

Born in 1945, the United Nations (UN) has the important tasks of avoiding future global wars and is the most important international governmental organization in the world. The UN aims are: a) to maintain international peace and security; b) to protect human rights; c) to deliver humanitarian aid worldwide; d) to promote sustainable development; and e) to uphold international law (22).

Maintain international peace and security: The *UN Security Council* has the primary responsibility for international peace and security by: a) working to prevent conflicts; b) helping parties in conflict make peace; c) peacekeeping; d) creating the conditions required to allow peace to hold and flourish.

Protect human rights: A key and guiding principle of the UN is to protect human rights through legal instruments and on-the-ground activities. To do so, it has established the *Office of the High Commissioner for Human Rights (OHCHR)*. The *United Nations High Commission for Refugees (UNHCR)* provides international protection and assistance for refugees, stateless persons and internally displaced persons, particularly in conflict-related emergencies. The *International Organization for Migration (IOM)* is an intergovernmental agency, which helps transfer refugees, internally displaced persons and others in need of internal or international migration services.

Deliver humanitarian aid: After having helped to rebuild Europe devastated by the Second World War, the UN is in charge of coordinating all the humanitarian relief operations due to disasters.

The *Office for the Coordination of Humanitarian Affairs (OCHA)* in collaboration with the Inter-Agency Standing Committee (IASC) is the arm of the United Nations responsible for bringing together national and international humanitarian providers to ensure a coherent response to emergencies. OCHA also ensures that a framework is in place within which each provider can contribute to the overall response effort. It also advocates for people in need, promotes preparedness and prevention and facilitates sustainable solutions. The *United Nations Children's Emergency Fund (UNICEF)* works to uphold children's rights, survival, development and protection by intervening in health, education, water, sanitation, hygiene, and protection. The *Food and Agriculture Organization (FAO)* provides early warning of impending food crises and assesses global food supply problems.

Promote sustainable development: To promote prosperity and economic opportunity, social well-being, and protection of the environment is one of the focuses of the UN in improving the well-being of people globally. The *World Food Program (WFP)* is the main supplier of relief food aid and the *United Nations Development Program (UNDP)* assists disaster-prone countries in contingency planning and with disaster mitigation, prevention and preparedness measures.

Uphold international law: The UN is an international treaty. One of the key parts of the organization's work is the development of and respect for international law. Courts, tribunals, multilateral treaties and the Security Council are approached by organizations for peacekeeping missions.

7.1 UN-OCHA

The United Nations Office for the Coordination of Humanitarian Affairs (OCHA) is a United Nations (UN) body formed in December 1991 by General Assembly Resolution 46/182. The resolution was designed to strengthen the UN's response to complex emergencies and disasters caused by nature. Earlier UN organizations with similar tasks were the Department of Humanitarian Affairs (DHA), and its predecessor, the Office of the United Nations Disaster Relief Coordinator (UNDRC). In 1998, due to the reorganization, DHA merged into OCHA and was designed to be the UN focal point for major disasters. It is a sitting observer of the United Nations Development Group. After merging with the DHA, its mandate was expanded to encompass the coordination of humanitarian response, policy development, and humanitarian advocacy. The agency's activities include organization and monitoring of humanitarian funding, as well as information exchange, coordination and rapid-response teams for emergency relief. (23)

OCHA has built up a range of services in the execution of its mandate. Some of the larger ones are:

- 1) Integrated Regional Information Networks (IRIN), a humanitarian news and analysis service (1995-2014). Since 1 January 2015, IRIN operates as an independent news service and is no longer affiliated with OCHA. (24)
- 2) INSARAG (International Search and Rescue Advisory Group) is a global network of more than 90 countries and organizations under the United Nations umbrella. This group deals with urban search and rescue (USAR) related issues, aiming to establish minimum international standards for USAR teams and methodology for international coordination in earthquake response based on the INSARAG Guidelines endorsed by the United Nations General Assembly Resolution 57/150 of 2002, on "Strengthening the Effectiveness and Coordination of International Urban Search and Rescue Assistance" (25)
- 3) ReliefWeb - is a humanitarian information portal provided by the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) founded in 1996. The service is managed by the

Digital Services Section of OCHA's Information Management Branch. ReliefWeb's editorial team monitors and collects information from more than 4,000 key sources, including humanitarian agencies at the international and local levels, governments, think tanks and research institutions, and the media. This portal delivered time-critical humanitarian information on Complex Emergencies and Disasters caused by nature and now hosts more than 720,000 humanitarian situation reports, press releases, evaluations, guidelines, assessments, maps and infographics. (26)

4) Central Emergency Response Fund (CERF) was established, by the United Nations General Assembly, in 2005 as the United Nations global emergency response fund, which enables humanitarian responders to deliver life-saving assistance whenever and wherever crises strike. (27).

5) Humanitarian Reform seeks to improve the effectiveness of humanitarian response by ensuring greater predictability, accountability, and partnership. The Emergency Relief Coordinator, together with the Inter-Agency Standing Committee (IASC) initiated the Human Reform process in 2005 (28-29).

6) Who does What Where Database and Contact Management Directory? To ensure that appropriate and timely humanitarian response is delivered during a disaster or emergency, information must be managed efficiently. The key information that is important to assess and ensure that humanitarian needs are met in any emergency/disaster: to know which organizations (Who) are carrying out what activities, (What) in which locations, and (Where), which is also universally referred to as the 3Ws (Who does What Where). The integrated Contact Management Directory complements the 3W database, making it easy for the user to navigate through the application. (30).

7) Common and Fundamental Operational Datasets (CODs) are critical datasets that are used to support the work of humanitarian actors across multiple sectors. They are considered a de-facto standard for the humanitarian community and should represent the best available datasets for each theme. The Fundamental Operational Datasets (FODs) are datasets that are relevant to a humanitarian operation, but are more specific to a particular sector or otherwise do not fit into one of the seven COD themes. (31).

Since 2004, OCHA has partnered with the Center for Excellence in Disaster Management (CEDM) and Humanitarian Assistance to facilitate OCHA's Civil-Military Coordination (UN-CMCoord) course in the Asia-Pacific Region. The UN-CMCoord Course is designed to address the need for coordination between international civilian humanitarian actors, especially UN humanitarian agencies, and international military forces in an international humanitarian emergency. This established UN training plays a critical role in building capacity to facilitate effective coordination in the field by bringing together approximately 30 practitioners from the spectrum of actors sharing operational space during a humanitarian crisis and train them on UN coordination mechanisms and internationally recognized guidelines for civil-military coordination. (32)

8. World Health Organization (WHO)

Public health at the international level is run by a specialized agency of the UN, i.e., WHO. The main mission of the WHO is to achieve better health by combating against both communicable diseases (e.g., influenza, HIV, malaria, Ebola, COVID-19) and non-communicable diseases (e.g., cancer, cardiac diseases, diabetes, malnutrition, substance abuse) for everyone and everywhere (33-34). Representatives from 194 Member States form the WHO over six regions worldwide, with an Executive Board, composed of 34 health specialists. Its mandate includes advocating for universal healthcare, monitoring public health risks, coordinating responses to health emergencies, and promoting human health and wellbeing. It provides technical assistance, creates international health standards and guidelines and collects data on global health issues through the World Health Survey.

Its flagship publication, the World Health Report, provides expert assessments of global health topics and health statistics on all nations. The WHO relies on contributions from Member States (both assessed and voluntary) and private donors for funding. (13-14).

9. USAID

USAID is a US Governmental Organization (35), whose mission is to “lead international development and humanitarian efforts to save lives, reduce poverty, strengthen democratic governance and help people progress beyond assistance”. USAID works in over 100 countries to: a) Promote global health, b) Support global stability, c) Provide humanitarian assistance, d) Catalyze innovation and partnership, and e) Empower women and girls.

B. International Non-Government Organizations

Asian Disaster Preparedness Center (ADPC)

ADPC is an autonomous international organization that works to build the resilience of people and institutions to disasters and climate change impacts in Asia and the Pacific. Established in 1986, it provides comprehensive technical services to Countries in the Region across social and physical sciences to support sustainable solutions for risk reduction and climate resilience. ADPC supports countries and communities in Asia and the Pacific in building their DRR systems, institutional mechanisms and capacities to become resilient to numerous hazards, such as floods, landslides, earthquake, cyclones, droughts, etc. The ADPC Academy designs and delivers specialist capacity building and training courses at all levels and enhances the capabilities of national training centers on DRR. ADPC has been supporting the Regional Consultative Committee on Disaster Management (RCC) since 2000 as its secretariat. Comprised of National Disaster Management Organizations (NDMOs) of 20 member countries, RCC serves as a non-binding mechanism to develop action strategies for disaster risk reduction (DRR); promote cooperative programs at regional and sub-regional levels; and provide guidance to ADPC on its future work and strategies in the region (36-37).

Cooperative for Assistance and Relief Everywhere (CARE)

CARE is an autonomous NGO that acts as major international humanitarian agency, delivering emergency relief and running long-term international development projects. It is one of the largest and oldest humanitarian aid organizations established in 1945 and focuses on fighting global poverty. In 2016, CARE reported working in 94 countries, supporting 962 poverty-fighting projects and humanitarian aid projects and reaching over 80 million people and 256 million people indirectly. CARE's programs in the low income and low middle-income countries (38) address a broad range of topics including emergency response, food security, water and sanitation, economic development, climate change, agriculture, education, and health. CARE also advocates at the local, national, and international levels for policy change and the rights of poor people. Within each of these areas, CARE focuses on empowering and meeting the needs of women and girls and promoting gender equality (38-39).

Médecins sans Frontières (MSF)

MSF or Doctors without Borders is an international, independent medical humanitarian organization, providing medical assistance to people affected by conflict, epidemics, disasters, or exclusion from healthcare. MSF is composed of tens of thousands of health professionals, logistic and administrative staff. Its actions are guided by medical ethics and the principles of impartiality, independence and neutrality (40-42).

OXFAM (Oxford Committee for Famine Relief)

OXFAM is a group of independent non-governmental organizations founded in 1995 with the objective to maximize efficiency and achieve greater impact to reduce global poverty and injustice. OXFAM works in more than 90 countries to save and protect lives in emergencies, help people rebuild their livelihoods and campaign for genuine, lasting change, and keeping women's rights (43-44).

World Vision

Founded in 1950, World Vision, is an Evangelical Christian humanitarian aid development and advocacy group, is a service organization that meets the emergency needs of missionaries. As an organization, it has an integrated holistic commitment to: transformational development, emergency relief, promotion of justice, partnership with churches, and public awareness. It is the largest international Christian non-governmental organization working in nearly 100 countries worldwide. The organization has consultative status with the United Nations Economic and Social Council and partnerships with UN agencies like UNICEF, WHO, UNHCR and ILO. Its approach to aid is to first help people and their communities recognize the resources that lie within them. It helps communities transform themselves by carrying out their own development projects in health care, agriculture production, water projects, education, micro-enterprise development, advocacy, disaster management, social accountability, nutrition, climate change, peace building and other community programs. World Vision collaborates with children, families and their communities to reach their potential by tackling the causes of poverty and injustice (45).

Conclusions

Governmental and Non-governmental Organizations play a major role in strengthening community resilience and capacity for crises and disasters and their participation in disaster management both pre-event (prevention, mitigation, and preparedness) and post-event (response and recovery) is fundamental for community readiness and favorable outcomes. Collaboration between these governmental and non-governmental organizations is necessary and desired. In this chapter, we described some of the major international players and the importance of the activities and contributions of these organizations. However, the following challenges may remain to be addressed:

1) The coordination between organizations, especially governmental organizations and non-governmental organizations, Civil and Military coordination, 2) The global networking, 3) The centralized registration of both personnel and equipment, 4) Education in Disaster Risk Reduction and Management, 5) Standardization of operations, 6) Coordination of protocols and procedures, and 7) Risk Communication and information integration and management. These challenges are crucial in creating a flexible surge capacity that contributes to a resilient society and allows the communication between various levels of disaster management (46-48).

Take-Home Messages

- Several international and national organizations take part in Humanitarian Emergency Aid missions. The relief organizations are essentially organized in 2 main groups, according to their source of funding: Governmental (funded by Governments), and Non-Governmental (funded by private donors).

- Non-Governmental Organizations (NGOs) are usually quicker in decision-making and deployment. This is why they are more often in charge of the implementation of activities in the field. Governmental Organizations are bound by complicated red tape and more bureaucratic, hence more adherent to policies and strategies.
- The known Governmental Organizations are the UN, and the ICRC. USAID, AusAID, JICA, ACMM, AHA Center and SELA are examples of humanitarian government agencies of the United States, Australia, Japan, Asia and Latin America, respectively. Medicines Sans Frontiers (MSF), OXFAM, Care, World Vision are well known Non-Governmental Organizations.
- The collaboration between different agencies with the local agencies is decisive for the success of the aid mission. Synchronization of the interagency collaboration, educational initiatives and training opportunity is crucial.

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Chapter 3

RISK AND VULNERABILITY ANALYSIS

Jarle Sørensen

Summary

No individual, organization, or society can be free of natural, manmade, or hybrid hazards. Natural hazards include hurricanes, wildfires, and flooding, while examples of manmade are terrorism, CBRNE-incidents, and structural fires. Hybrid dangers are the results of both man-made and natural forces. They can also be defined as synchronized attacks through a broad set of destructive measures, such as the combination of fake news, economic pressure, and military aggression. While not a new phenomenon, hybrid threats have gained new topicality, especially following the 2014 Russian hybrid attacks on Ukraine. A systematic management approach is needed to risk society to ensure the best possible mitigation and preparedness efforts. This chapter will introduce the readers to the concepts of risk and risk management. The focus will be on how to prepare for and conduct a risk and vulnerability analysis (RVA). Towards the end, there will be some take-home messages on dealing with uncertainty and avoiding common mistakes.

Introduction

There is no unified definition of the concept of *risk*. Some researchers base their understanding on the traditional formula of likelihood and consequence (the technical-economic perspective); others focus more on the relationship between undesirable events and uncertainty (the psychological perspective). While some argue that risk is subjective and dependent on facts and existing sources, others consider it to be more ontological and free of its evaluator's opinions (2). Traditionally, the chosen approach has often been associated with affiliation to a specific field or discipline, such as economy, sociology, psychology, culture, and medicine (3). While there are some fields where it would be possible to quantify exact degrees of provability or consequences based on existing historical or quantitative data, there are also other areas where it will be necessary to consider more subjective and often uncertain factors (4). Take the example of school-massacres. In Norway, there has never been such an incident. However, there have been cases in, e.g., the United States, Sweden, Spain, and Poland. In terms of mitigation and preparedness efforts, what is then the risk of the same happening in Norway? Based on the logic that the likelihood can only be estimated based on previous occurrences, the answer will be zero. However, when doing a compilation of other comparable countries and analyzing current cultural and political trends, it might be argued that a likelihood is present and that it would be wise to both mitigate and prepare for such threats. The process of identifying, assessing, and controlling risk either to an organization or to a community is often referred to as Risk Management or Risk Governance.

Risk Management

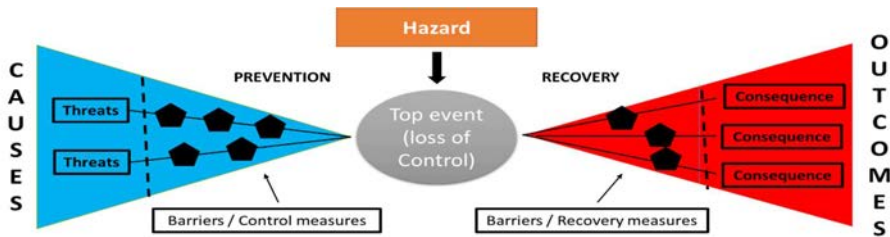
Risk management is the process of identifying, assessing, and controlling risk. As no individual, organization, or community is free of all hazards, there has to be a system in place that ensures a systematic and structured approach to mitigating and preparedness efforts. The ability to maintain essential functions, withstand adversity from unwanted events, and bounce back to a normal state, is often referred to as *resilience* (5). From the risk management viewpoint, building resilience has both an organizational and administrative side. On the organizational side, it has to do with at all times relocating and managing sufficient materials and resources needed to respond to both routine-based and extraordinary events. Administratively, it has to build robust and highly reliable everyday

organizations and infrastructures (4). For example, facilitating sufficient intra- and intersectoral collaboration will be of importance, as a crisis often tends to strain and challenge existing and unique resources (6). However, before measures can be implemented, risks have to be identified, and vulnerabilities have to be mapped. This process is called a Risk and Vulnerability Analysis (RVA).

Risk and Vulnerability Analysis

A risk and vulnerability analysis (RVA) can be used as a decision-making tool. It can detect and handle discrepancies, quality-assured tasks, and prioritize activities (7). Just as with the term risk, there is no universal or standardized definition or way to conduct an RVA. There exist multiple approaches and models. These differences often cause confusion and misunderstandings, especially when results are being presented or analysis compared. The Bowtie risk evaluation model inspires the method presented in this chapter. As a starting point, Bowtie takes a specific initiating or unwanted event and outlines associated causal relationships and consequences (8). The Bowtie model earns its name after its visual form. It looks like a man’s Bowtie with causes to the left, a top event in the middle, and outcomes to the right (see Figure 1). The model has gone through several historical developments, ranging from the Bell laboratory’s Fault Tree Analysis in 1961 (9) to Dan Nielsen’s Cause Consequence Diagram (10) and Haddon’s Barrier thinking (11). In recent years, several new aspects have been added, and variations have been developed. A well-known example is the early 90s “Shell bowtie model” following the 1988 Piper Alpha oil-rig fire disaster, killing 167 people (8). Regardless of methodology, an RVA process should at least consist of the three main steps; preparation and planning, analysis, and presentation and recommendations. The following section will walk through the different stages. A surgical procedure will be used as an illustrative example.

Figure 1. The Bowtie model



Step 1: Preparation and Planning

Before starting the process of identifying and assessing risk, it is vital to have a defined mandate, a plan, and a clearly defined scope. As there is seldom time, nor wise to try to examine organizations as a whole, it is recommended to divide the analysis object into smaller sections and rather perform multiple and more pointed analysis. Before you start analyzing, spend some time collecting as much background information about the analysis object as possible. To help with the information gathering and analysis process, get a team together to examine the analysis object from different angles. Remember, the view and knowledge of risk often look different based on background and experience. A goal should therefore be to assemble as broad and interdisciplinary team as possible. Start by formulating an above hazard and a top event. An overhead hazard is a dangerous activity, while a top event is the actual happening, or put in another way; the point in time that describes the loss of control over a hazard. Note that the top event should always be the starting point. No damage has happened at this point, but there is an existing potential. Before moving on to the actual risk and vulnerability

assessment, ensure that all the members have a common understanding of the object, scope, and methodology.

Example 1: In this case, the above hazard will be performing surgery, while the top event is losing control of the patient's vital signs.

Step 2: Analysis

A) Threat identification. The analysis process starts by detecting threats or, in another way, identifying events or happenings that may cause the top event. Hazards can be natural, man-made, or hybrid, as well as intended and unintended (12). As threat identification lays the foundation for further analysis (13), make sure to spend some time on this step. Start by asking each member to brainstorm for possible dangers freely. You can write them down on a board, use Post-It Notes, or a digital word cloud. When completed, move on to mapping associated consequences.

Example 2A: Causes that led to losing a patient's vital signs could include loss of power, instrument malfunction, cardiac arrest, or human mistakes (due to fatigue, loss of attention, sickness, drug abuse, etc.).

B) Consequence identification. There are multiple ways to present consequences, but using a systematic matrix that outlines potential losses or damages to some key societal values is recommended. Four applicable value-groups are 1) human life and health, 2) societal stability, 3) nature and environment, and 4) material or reputational. As in the earlier threat identification step, there are no right or wrong answers regarding mapping consequences. To get a full overview, remember to include both incidents that already could have happened and those that have not.

Example 2B: Losing of vital signs to the identified causes can lead to several consequences. Criteria that affect human life and health are decreased body temperature, cardiac arrest, respiratory malfunction, and blood pressure drop. The event could also affect material or reputational values, as it could lead to financial loss for the hospital, or a reputational loss for the medical team or individual surgeon.

C) Barrier mapping. When the team has outlined possible threats and consequences, it is time to map out barriers. Barriers are often classified as people (personnel that operates, maintain, and monitor), processes (procedures), and plant (technical equipment or structures). On the Bowtie-model's left (threat) side, barriers are those mechanisms an organization or a society has in place to prevent each unwanted scenario from unfolding. On the right side (consequences), barriers are those tools that can help the object mitigate or recover from the loss of control or an exalting negative development. Note that barriers should be assigned to the individual threat or consequence. When doing this exercise, try to range the barriers in a logical order from optimal to a minimum, where the latter is the last line of defense before the top event occurs.

Example 2C: Barriers associated with, e.g., loss of power threat could be performing a hospital power grid update, controlling and monitoring the power consumption, or installing an emergency power system in the operating room. Barriers to mitigate the consequence of cardiac arrest could be medications, defibrillators, and CPR procedures.

D) Vulnerability assessment. The identification of barriers gives you a good overview of existing protection mechanisms. However, no barrier is perfect. There will always be elements that make the barriers less useful, unreliable, or insufficient. Such features are called escalating or vulnerable factors and can be identified by performing a vulnerability assessment. A vulnerability assessment systematically identifies and outlines weaknesses. Here, it is essential to focus on the missing or not presented measures and possible flaws in existing protection mechanisms. There exist different groups of vulnerabilities. Organizational vulnerabilities include lacking or inadequate policies, mandates,

RVA-analysis, or frameworks. Technological are features like access control, video surveillance (CCTV), surge protection, and external power supply. Human vulnerabilities are lacking or inadequate training, understanding, situational awareness, and unintentional error.

Example 2D: *To mitigate the consequences of losing power, the hospital has installed emergency generators in every operating room. However, if routines are lacking, the personnel have not received adequate training, or if the generator has not been sufficiently maintained, these would be examples of existing vulnerabilities.*

E) Likelihood assessment. The likelihood is the probability of occurrence. It is important to indicate the possibility in an RVA-analysis, as it may help the analysis group and decision-makers to make the right mitigation and preparedness priorities. However, assessing an event's probability can be a demanding exercise, especially if the event is rare, unique, or if there are no accident statistics or historical data available. If sources are missing, expert help or local knowledge can assist with the RVA-analyses from other comparable fields or areas (13). The likelihood can be presented on a 5-point scale, where one = very unlikely and five = very likely based on the acquired information.

Example 2E: *If there has been a power loss in the OR once a week for the last two months, it is very likely that the same will occur the following week. Suppose your hospital has not yet experienced a power loss, but it has happened to several other hospitals in the same area. In that case, a likelihood should be considered, as it may indicate problems with the local power-grid capacity.*

Step 3: Presentation and recommendations

When the analysis is complete, there is time to compile the results, present an overall assessment of risk, and make recommendations. While form and scope may differ based on the mandate, organizational culture, and setting, a golden rule should always keep it as simple as possible. Clearly state what hazard and the top event have been analyzed, who participated in the process, and what you found. When it comes to making recommendations, make sure that they are clear, concrete, and realistic. As mitigation and preparedness efforts often are costly, make sure that your initial suggestions are within realistic budgets and timeframes. It is better to take one step at a time than to try to do everything at once.

Take-Home Messages

- Regardless of how well you plan and prepare, all RVA processes will have some elements of uncertainty to them. This insecurity involves both when and whether the event will progress and scope of consequences, and barriers' overall effects. This is normal. Documenting such insecurity is however recommended, as it can assist the managerial level make timely and thoughtful decisions, initiate, and implement the correct measures.
- The purpose of assessing and documenting uncertainty is not to create more confusion but rather to highlight the need for new knowledge (13).
- Be aware of typical RVA pitfalls; a) a too narrow composition of the analysis team. The more interdisciplinary the group is, the greater the chance of identifying various threats and vulnerabilities, b) combining and mixing methodologies. No risk and vulnerability analysis model is one hundred percent accurate. Therefore, it is recommended to select, learn and be true to one approach, and c) make sure that an RVA becomes more than just a theoretical exercise. When making recommendations, always assign and include associated roles and responsibilities, and always remember that risk concerns everyone, not just safety and security professionals.

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Chapter 4

ETHICAL ASPECTS OF DISASTERS

Attila Hertelendy

Summary

The challenge of working morally and ethically means that learners will inevitably encounter situations where there are competing obligations. In such situations, it is tempting to retreat from all moral and ethical analysis in order to escape a sense of what may appear to be irreconcilable ethical tension. The field of disaster management and the practice of crisis management are rife with ethical dilemmas, which can impede and severely affect the ability of international crisis response teams to act. As an example, ethical challenges reached a crescendo during the COVID-19 pandemic where governments and healthcare workers had to make difficult life and death decisions unparalleled in recent history. Civil disaster response teams may, at any time, be faced with on-the-spot ethical dilemmas that must be dealt with, for the sake of the affected population as well as the response teams own mental and psychological health. Such dilemmas come about because of limited resources, the need to choose between difficult options and inconsistencies between the aims and backgrounds of relief teams and of actors in the host country. Ethical problems and dilemmas will face the disaster relief team and its managers at every step of the process. This chapter is intended to be of assistance in ethical and moral circumstances by directing attention to the variety of ethical factors that may need to be taken into consideration and to alternative ways of approaching ethics. It aims to prepare the individual member of a disaster relief mission to incorporate ethical considerations into relevant activities.

Introduction

Disasters pose a major threat not only to the survival of populations and societies as a whole but also to the dignity and safety of individuals and to the preservation of the natural, cultural and environmental heritage. As an example, the COVID-19 pandemic resulted in numerous ethical and moral challenges. As infected patients began to seek medical attention, hospitalizations surged creating significant demand for intensive care units and ventilators for patients experiencing respiratory complications. Some hospitals experienced crisis where rationing needed to occur and healthcare workers had to make difficult ethical choices in rationing resources and deciding who receives a ventilator and who does not (1-2). Adaptive responses were required to implement crisis standards of care to address ethical challenges that arose when trying to provide the standard of care and quality reserved for individualized patient care in a resource challenged environment. This required a shift from doing what is best for the individual patient to the most good for the greatest number of people (3).

The chaos and disorganization in society caused by disasters can result in a serious violation of the entire range of human rights. Although all populations may be affected by various human right infringements, the outcome is more evident in vulnerable societies; risk exposure limits resilience and affects individuals, communities and the environment based on their vulnerability. Thus, more vulnerable groups and societies are more strongly affected by disasters and have less resilience, yet, until recently have not been given priority in prevention strategies or operational manuals. The COVID-19 pandemic exposed vulnerabilities in emergency and disaster planning response and preparedness. Minority populations often living in poverty have been disproportionately affected by

the crisis (4). Similarly, the disabled, elderly and those with special needs have not received equitable and fair treatment access and priority in many parts of the world (3, 5).

Considering the impact of disasters on human rights, in the absence of a specific universal binding legal instrument, it seems imperative to formulate essential ethical principles as part of a minimum set of ethical standards for the various parties concerned in prevention, action and reconstruction strategies. Increased resilience is dependent on reducing vulnerability as a whole, whether it is linked to poverty, gender, health, insecurity, family break-up, fear or panic; that reduction requires ethically responsible practice. The international community, international organizations, non-governmental organizations and companies have a duty to adopt prevention, assistance and reconstruction measures to protect individuals, natural, historical and cultural heritage, property and means of development and subsistence from disasters, while taking account at all times, in all places and without discrimination, of the need to protect the fundamental rights of those concerned (6-8). The assistance of local, regional and national authorities are crucial for implementing these measures.

Healthcare providers, in particular, have an obligation to deliver care and services consistent with professional ethical standards. In the event of a catastrophic natural or human-caused disaster, these obligations can become complicated under crisis standards of care when difficult decisions may need to be made about the allocation of resources. In disaster planning, consistency, fairness, effectiveness, and transparency are best achieved by engagement with stakeholder communities, so that planning is informed by the values, norms, and moral traditions of that community. Well-intentioned responses to a disaster or a crisis without a solid ethical framework can result in adverse outcomes. To illustrate, consider a quarantine during an epidemic or pandemic. Over the last two decades, SARS-CoV-1, MERS, Ebola, and other emerging infectious diseases have each resulted in unique sets of problems for applying quarantine ethics. Quarantine often creates conflicting ethical values as it creates and worsens unequal burdens and benefits among individuals and groups. Cultural differences and political pressures can create decision-making challenges and that can undermine the importance of ethical values (9). Moore (10) described the ethical challenges of previous quarantine frameworks utilized during the Ebola 2013-2016 outbreak in West Africa. Specifically, the author suggested that the quarantine intervention that occurred at West Point, a slum of 75,000 people in the Liberian capital, Monrovia may not have adequately addressed the West Africa's social and cultural values. Since the ethical frameworks used in West Africa were from a western perspective, the author suggests new frameworks for quarantine be considered to address ethical concerns pertinent to West Africa. The COVID-19 pandemic introduced significantly more complex ethical considerations, related to quarantine, social distancing, and isolation requiring governments to enact pandemic ethics, capable of adapting to the digital age (9, 11).

The cross-border impact of disasters should not be forgotten and requires preventive measures, a common, concerted response, co-operation between governments and local and regional authorities, and the involvement of civil society. At all events, only better anticipation and improved prevention will be able to reduce the risk of deliberate or unintentional breaches of the human rights liable to affect both direct and indirect disaster victims. Consideration must also be given to simultaneous disasters and conflict. During 2020, in the midst of the COVID-19 pandemic, healthcare workers in Armenia were required to treat COVID-19 patients and injured casualties of war from the Armenia – Azerbaijan conflict. The war began over Nagorno-Karabakh on September 27, 2020 lasting 44 days. The conflict claimed approximately 5,000 Armenian lives, and many more wounded. This very complex humanitarian conflict resulted in significant psychosocial trauma due the severe mental and emotional stress placed on overworked and under resourced healthcare workers (12).

Good governance in disaster management requires the straightforward participation of the population in the planning and decision-making processes regarding the reduction of risks linked to natural and technological eventualities concerning them. Good governance also forces people to account for their actions and, hence, reduces the risk of corruption in government, in civil services and in society. Finally, it should be emphasized that the human rights of indigenous communities and local populations require special protection, taking account of their customs, cultures and particular relations with the environment, which make them more vulnerable to the risks of disaster, while emphasizing the importance of their knowledge of the locality and its history to risk prevention and reconstruction (13-14).

The COVID-19 pandemic has resulted in the greatest global loss of life and economic impact due to a respiratory virus since the 1918 influenza pandemic. This can be considered one of the largest disasters affecting humanity in recent history. Many lessons will be learned by examining the policies and actions taken by governments and public health leaders during the pandemic. As disasters continue to become more complex, exacerbated by climate change, and other external factors ethical guidelines and framework for disasters will need to be updated to address gaps identified during the COVID-19 pandemic. (14-15). In the interim, there are some general ethical principles on disaster risk reduction and people's resilience, which can be briefly listed (6, 8, 16):

- **Solidarity:** Between nations and people to strengthen disaster resilience and help victims, especially vulnerable groups. The costs and burdens of disasters, as well as the benefits of risk reduction measures, should be shared equitably.
- **Joint responsibility:** All stakeholders have a joint responsibility in disaster risk reduction and efficient contribution in the face of emergencies.
- **Non-discrimination:** All steps in the management of a disaster's various phases, including fundamental human rights should be secured and implemented without any discrimination.
- **Humanity:** All individuals, including vulnerable groups, should be treated based on humanity and with respect, tolerance, and compassion, regardless of the nature, origin, duration and place of the disaster.
- **Impartiality:** Disaster prevention, preparedness, relief and recovery measures should be implemented and provided based on genuine needs alone, without any favoritism between or within the population groups concerned.
- **Prevention:** All authorities from national to the local have a responsibility to implement preventive measures with the most active involvement possible, more than all other stakeholders. Various variables such as geography, demography and climate change should be taken into consideration.
- **The role of the media:** The media plays an essential role in informing the public and raising awareness through reporting, and forecasting disasters and the way they evolve. They must treat disaster victims with dignity and with full respect for their privacy.
- **Neutrality:** Measures for the management of all phases of disasters should be taken without political, racial, religious or ideological debate, and with the sole aim of protecting individuals and their rights, the environment, property and heritage, and thereby strengthening resilience to this type of event.
- **Co-operation:** States should co-operate, regardless of political, economic, social and cultural differences and according to their capacities, to strengthen disaster resilience and to secure respect for human rights, showing particular regard for the possible cross-border impact of disasters and the need for joint action.

- **Territorial sovereignty:** States should guarantee human rights not only for their nationals but also for foreigners on their territory including humanitarian assistance teams from abroad at the time of disaster.
- **Autonomy:** Respect for other persons' right to be self-governing.
- **Beneficence:** A commitment to promoting others' wellbeing.
- **Non-maleficence:** A commitment to avoiding harm to others.
- **Self-respect:** Fostering the learner's self-knowledge and care for self.
- Since a disaster's various phases consist of different risks, events, and measures, diverse ethical principles may be applicable to the period before, during or after a disaster (17).

Ethical principles applied before disasters

- o The introduction of prevention measures to the entire population.
- o The right to a healthy environment.
- o Education, training, and awareness raising about resilience to disasters.
- o Prior information.
- o The right of participation in all phases without any restrictions.
- o Freedom of expression.
- o Access to justice.
- o Disaster prevention at the workplace.
- o Disaster prevention in recreation and tourist areas.
- o Disaster prevention in public places, particularly schools and hospitals.
- o Special prevention measures for the most vulnerable groups.
- o Organization of and participation in emergency drills.
- o Preventive evacuation of populations.

The ethical principles applied during disasters

- o Humanitarian assistance for all.
- o Information and participation during disasters.
- o Compulsory evacuation of populations.
- o Respect for personal dignity.
- o Respect of personal rights.
- o Emergency assistance for the most vulnerable persons.
- o The importance of rescue workers respects for human rights, dignity, humanity, solidarity, hope, and impartiality.
- o Measures to safeguard and rehabilitate the environment.
- o Necessary measures to safeguard and restore social ties (meeting places, places of worship and places for leisure activities).

The ethical principles applied after disasters

- o Strengthening resilience to the effects of disasters (getting back to normalcy).
- o Necessary measures to adopt the requisite measures to ensure that human rights are protected and promoted during all reconstruction and rehabilitation work, and to investigate infringements of those rights.
- o Protection of economic, social and cultural rights.
- o Protection of civil and political rights.

Conclusion

The ethical theories individuals utilize are going to vary from person to person, and even be used in combination amongst themselves based on local situations. Personal preferences cause specific decision-making processes to be “weighted” or biased. A decision maker must attempt to create the most ideal outcome they can foresee, which will likely draw on their own experiences, their ability to sympathize and empathize with individuals affected, and what the possible negative consequences could be. As disasters are likely to evolve due to the effects of global warming, interpretation of ethical frameworks meant to guide global decision-making will need to be sensitive and adaptive to local cultures, customs and political structures.

Take-Home Messages

- In disaster planning and response, consistency, fairness, effectiveness, and transparency are best achieved by engagement with stakeholder communities, so that planning is informed by the values, norms, and moral traditions of that community.
- Ethical frameworks for disaster response are dynamic and require updating to reflect best practices, and lessons learned from previous disasters.
- The COVID-19 pandemic is an example of where existing disaster ethical frameworks could not be consistently and uniformly applied globally. Changes to global ethical frameworks that guide future disaster responses should be initiated through coordinating entities such as the UN and WHO based on lessons learned from past disasters and humanitarian crises.

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Chapter 5

LEGAL ASPECTS IN DISASTERS

Amir Khorram-Manesh

Summary

Nearly all actions during disaster response will have legal implications. Each country will have its own legal considerations, limitations, and possibilities that will affect activities and outcomes. It is important to be acquainted with potential legal issues that may affect the outcome of any incident, and with the legal framework of the affected nation. International and national legal perspectives of all incidents should be respected and well-studied at all managerial levels. The aim of this chapter is to give readers, at their respective levels, the required awareness of the multitude of legal issues inherent in decisions and actions in disaster response. For all levels, it should become clear that awareness and knowledge of legal consequences and requirements apply to nearly all actions in disaster response. Not everybody will or should have a lawyer by their side, but all actions and decisions should be conducted in accordance with the International Humanitarian Law as well as being subject to local legal frameworks. This applies to general managerial responsibilities, as well as specific situations in a disaster response. This chapter is intended to familiarize the reader with legal issues that can affect disaster response teams, but does not replace any legal references and is not intended to denote any legal documentation or guidance.

Introduction

For volunteers at a disaster scene, the main goal is to help, to prevent the situation from becoming worse; legal documents or considerations of liabilities seem out of place (1). Yet legal considerations are becoming more of a factor in disasters (2). For example, a decade ago emergency service organizations (“ESOs”) were rarely sued, rarely questioned and rarely thought to be affected by legislation such as the Occupational Health and Safety acts. This is no longer the case, and ESOs and their employees and volunteers need to be aware of the legal ramifications for what they do. All actions in a disaster response will take place within some legal context (1-4). Some of the most prominent issues include:

- Who can declare a situation to be a disaster and what changes will that bring to the legal framework under which the disaster relief team is working.
- What are the legal procedures and consequences in a multinational disaster response?
- To what degree can professional considerations override individual rights (for example, if an area needs to be evacuated – can you force residents to leave? What if they refuse?)
- Who is legally responsible for a response team in the foreign nation (for example, what happens if a volunteer makes bad choices or turns out to be incompetent?)
- What is the liability of personal decision-making in a disaster in another country (for example, what are the local legal parameters where decisions require making the “best choice in a bad situation?” How is this to be proven in court?)
- How can a response team access state funding or resources (for example, how does one account for funds acquired locally?)
- What are the legal obligations for cross-border personnel and materiel movement (for example, visas, work permits, import licenses, customs duties for emergency equipment, supplies, and personal medical luggage?)

- What is the legal framework for the involvement or partnership with military forces (for example, requests for transportation, for security assistance, demands by armed forces for priority treatment of soldiers?)
- Who is legally responsible for coordination of international response?

One major problem is that there is no single all-inclusive international law for disaster response. The International Red Cross has published studies for many individual countries over the past three decades, trying to improve their awareness of the need for disaster preparedness and attempting to establish legal frameworks to make the international work easier (3-4). Nevertheless, to date, the attempt to establish standard International Disaster Response Laws (IDRL, called simply “Disaster Law“ since 2011) has been hampered by the dispersed nature of these laws, lack of awareness, significant gaps in scope and coverage and non-implementation of relevant instruments among the key stakeholders. The gaps are particularly evident in the areas of quality and accountability, which benefit mainly from “soft” legal regimes emphasizing voluntary compliance.

DRM (Disaster Risk Management) laws should define the priorities, institutional mandates and other aspects of a national DRM system. In practice, DRM laws vary internationally, in the extent to which they include themes such as national DRM policy and planning, local government responsibilities, resource allocation, community and civil society participation, early warning systems (EWS), and education and public awareness. In some cases, these themes are part of a dedicated DRM law, and in others, they are included in separate or companion laws that form part of the legal framework (5-9).

Although some countries highly prioritize and integrate Disaster Risk Reduction (DRR) into their legal framework, there is still considerable potential to make DRR a higher priority in the respective legal frameworks and in their implementation in other nations. DRR is often a more distinct priority in policies, plans and strategies, which can be used both to set the agenda for the law reform process and as a key tool to guide the implementation of laws. A single agency, such as a national disaster management agency or a civil defence office, is often established as the national focal point for cultivating a whole-of-community approach to DRR and providing national leadership and policy direction. However, these offices often need to strengthen their legal coordination with other sectors and stakeholders, especially those related to development planning and climate change adaptation (CCA). They also need to be given clear legal mandates and authority for DRR, matched with mandated resources and capacity. Funding for DRR from the national to the local level has been a challenge that has hampered implementation in many countries (6-10).

DRM laws in some countries make special provision for the participation of civil society and communities, including women and vulnerable groups, such as the socially excluded, the elderly, people with disabilities, children and the poorest people. However, in practice, there is often less participation in the advisory and implementing institutions than the law may intend. The input of civil society organizations, communities, women and vulnerable groups is a key part of DRR strategies because it recognizes communities’ rights to be involved in their own risk management and takes special account of the needs of vulnerable groups.

Early Warning Systems (EWS) have been developed in a variety of ways. Some are regulated by law, and others are governed by policy and administrative practice. Many EWS are designed only for specific major hazards, so that not all relevant risks in a country are necessarily covered by their mandates. Some DRM laws include specific provisions on risk mapping, an essential underpinning of effective EWS. Some of the countries’ legal frameworks feature provisions on education and public awareness on DRR, such as requiring public authorities to conduct community education on DRR and disaster preparedness drills in schools, as well as to include the subject in school curricula. Some laws

also mandate the establishment of special training facilities or curricula aimed at adult professionals as a long-term strategy to build national capacity in DRR and DRM (9-14).

Conclusion

Nearly all actions during disaster response will have legal implications. Each country will have its own legal considerations, limitations, and possibilities that will affect activities and outcomes. International and national legal perspectives of all incidents should be respected and well-studied at all managerial levels. There is a need for awareness of the multitude of legal issues inherent in decisions and actions in disaster response since all actions and decisions should be conducted in accordance with the International Humanitarian Law as well as being subject to local legal frameworks. This applies to general managerial responsibilities, as well as specific situations in a disaster response. This chapter offers some insights about the legal issues that can affect disaster response teams, but does not replace any legal references nor denote any legal documentation.

Take-Home Messages

It is important to be acquainted with potential legal issues that may affect the outcome of any incident, and with the legal framework of the affected nation.

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Chapter 6

POLITICAL CONSIDERATIONS IN DISASTERS

Amir Khorram-Manesh

Summary

The necessity of dealing with political realities in the host country will come up in any disaster relief project. Senior members of the team will have to deal with donor countries and EU or international institutions as well. The aims of this chapter is to; prepare readers to identify and understand the influence of politics on their work; to prepare managers to manage the disaster relief team effectively within the limits of political action; to prepare managers to develop and implement plans for effectively interacting with the political echelon at national and local levels in the disaster-hit country and in the home country; to prepare readers to identify and effectively interact with local political/government agencies that could enhance disaster relief work; to prepare readers to effectively debate and overcome internal differences of opinion.

Introduction

Disaster relief takes place within a complex political environment (international, national, and local), which plays a significant factor in the preparation for, response to, recovery from and mitigation of disaster events. Politics is the process of establishing and carrying out public policy. The outcomes of all phases of disaster management are directly related to how well emergency/disaster policy is created, maintained and implemented. Failure in the development of disaster management policy will not only influence policymakers, but can also have social and economic consequences. Furthermore, in the era of mass communications, disasters are dramatic, newsworthy events, which compel intense public interest. Politicians have to account for and respond to that kind of interest and scrutiny.

One of the difficulties for emergency managers at all levels of government is to get policy support from senior elected officials before a disaster event occurs. Disaster policy issues are often monumental and very complicated and involve conflicting interests at every level of government. Therefore, elected officials are reluctant to initiate controversy and debate about disaster response until the need is immediate and unavoidable. Even when the need to establish a policy in advance of disasters is accepted and understood, the process of establishing and maintaining such a policy is a challenging undertaking. However, the needs are constantly changing and the public expectations in response to a disaster are invariably unreasonably high. This calls for a better collaboration at all political levels since disasters and their aftermath have significant potential to affect people at all levels. All political leaders are subject to the impact of disasters. A disaster can alter the public's perceptions of the ability and concern of political players. It also causes politicians to be more sensitive to criticism of response/relief efforts. Disaster response and recovery actions are almost inevitably driven, in part, by political considerations. Sometimes these political considerations can produce very negative consequences, which can range from mere inconveniences (tours by elected officials of disaster sites) to major interference in the accomplishment of response and recovery objectives (lack of funds, refusal to grant necessary authority, demands for newsworthy but unnecessary actions, etc). On some occasions, these consequences can result in illegal or unethical actions (for example, use of disaster powers for personal gain or influence).

It is important for local emergency managers to become aware of the potential for such political interference to get out of hand and be able to devise tactful strategies for dealing with them. Well-established emergency operating plans and processes, frequent orientation, training, and exercising will help elected officials

understand the importance of pre-established roles, responsibilities and relationships and the necessity of operating as a team with a plan when disaster strikes. While in a minority of cases, there may be unwanted and excessive political interference in disaster operations, political operatives are usually content to play by the rules, as long as things are under control and there is a cogent, integrated effort during the response and recovery. When there is a real or perceived lack of control or coordination and things either are or appear to be in chaos, then political leaders tend to “take charge”. Disaster relief managers need to be as professional as possible, understand the emergency management process and principles and be able to communicate them before, during and after a disaster strikes. They need to make sound, complete, and flexible plans and establish good relationships with politicians and media before, during, and after the event.

The degree to which a disaster situation is politicized varies. Greater political intervention may occur when:

- Violence or other human actions initiate rapidly developing events, as for example, in cases of mass terror attacks.
- The disaster is affected by public policies. This can be influenced by such things as the level of response required, or the need to deal with difficult or uncharacteristic issues which have a negative impact on the public (e.g., evacuations, seizure of private property) or events or potential events which could have been prevented or lessened by mitigation actions (e.g. flooding, earthquakes).
- The quality of decisions and response actions by the political echelon or others are questioned.
- If the nature of the political environment in the community is competitive. For example, if partisan politics interfered with the development or implementation of disaster public policy.

National or local political actors are needed as a part of disaster relief management since they have *power and the special authority* required during a declared disaster. Most states have their disaster legislation, which allows exercising special authority by duly elected officials. In a democratic society, only a duly elected representative can authorize extraordinary measures during a disaster, which will limit the ordinary rights and privileges of citizens. Elected officials are also potentially effective in *expediting assistance*. The process of requesting, justifying and acquiring such assistance is one of the most “political” of all disaster actions. Finally, politicians represent the people and in a democracy, they hold the ultimate authority and are the most appropriate spokespersons when it comes to providing guidance to the public and obtaining public support for disaster-related actions.

Conclusions

There are several political impacts on all phases of disaster management. These impacts can be financial and/or operational. Financial support is needed for all phases and may include support for educational initiatives, training, and resource availability. Political influence is also necessary for making policies and guidelines and promotes a healthy relationship between politicians, professionals and the public. The COVID-19 pandemic demonstrated the increased trust needed by politicians to implement public health measures. Trust between politicians, disaster professionals and the public is especially important in an era of technological development and population-based management of an ever-increasing number of disasters and public health emergencies (8-9).

Take-Home Messages

- Identify and understand the influence of politics in disaster management and manage the tasks within the limits of political action.
- Develop and implement plans for effectively interacting with the political echelon at international, national and local political/government agencies that could enhance disaster relief work.

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Chapter 7

CULTURAL ASPECTS IN DISASTERS

Eric Carlström, Emelia Santamaria

Summary

If not considered for, cultural factors can be harmful to the collaboration in the international and interdisciplinary disaster team. Clarifying concepts, identifying agendas, and interpreting cultural behaviors may reduce the likelihood of poor communication and work difficulties between disaster teams from different countries, regions, and professions. On individual level, actor to actor, the emphasis is on cultural awareness, and skills to allow the actor to understand cultural issues. At higher levels, the emphasis is on cultural theory and training commanders to identify and deal with cultural issues in crisis settings. The aim of this chapter is to give a brief insight on the challenge of integrating cultures during the emergency work. It includes some theoretical frameworks and picks a few empirical examples from the field. The chapter includes hints to trainers and lecturers in disaster and crisis management to accommodate cultural aspects into the curricula.

Introduction

Ongoing disasters are not limited to national borders. Disasters caused by nature affect several countries and regions simultaneously. One example is the 2004 Tsunami whose origin was a spot outside the coast of the Indonesian Island Sumatra, where an undersea earthquake diffused and caused the death of at least 225,000 people in a dozen countries (1). Manmade disasters have also become international. Political and religious extremism growing in one country may create violence, escalate as terrorism, and create cultural and religious sensitive conditions on the other side of the world, e.g., the terrorist attack on the offices of the French satirical newspaper, Charlie Hebdo in Paris in January 2015. The incident resulted in 12 deaths, 11 injuries and temporarily closure of French embassies and schools in around 20 countries because of fears of reprisals (2). In an organizational perspective, the lack of legitimacy and trust creates barriers to collaboration. Depending on traditions, one authority may not see a need to engage in emergencies themselves because they perceive other to be responsible. Such projections of action are examples of the so-called “risk perception paradox”, where organizations do not collaborate to handle serious threats (3).

Cultural factors

Cultural factors are a mix of social values, religious beliefs, tradition, and attachment to a location. It is a “how we do here” or “the way of” a certain population, organization, profession, or group. Culture is social constructs learned from others in one’s environment. Symbols, metaphors, rituals, anecdotes, and artifacts that manifest values and guide individual actions can identify the culture. A familiar ritual or artifact can be confidence boosting and substitute personal acquaintance. Culture is often emphasized as a link or transition between individual and collective behavior. This refers to the idea that an organizational culture is “embodied” in individuals but shared by the collective (4-5).

Organizational cultures may induce inertia, maintain social structures, and promote unitarianism. Despite this, organizational cultures have not always displayed the level of cohesion that has come to be expected. Long lasting cultural influences are expected to induce a low willingness to change. Artifacts and behaviors play an important role for new and old members both socially and for acceptance into the team. Such artifacts can consist of equipment and uniforms that signal the belonging to a team, prestige and competence. If new recruits display confidence-boosting artifacts to their more experienced colleagues, it increases their chance of being accepted (3, 6).

Culture can be material as well as non-material. Material culture consists of physical or tangible creations, e.g., houses, historical artifacts, cars, equipment, personal belongings, and decorations. Nonmaterial culture consists of intangible human creations of a society that influence people's behavior. Major components of nonmaterial culture are comprised of metaphors, rituals, anecdotes, myths, artifacts, symbols, language, values, and norms (7-8).

- **Rituals:** Rituals are sets of often-repeated, non-instrumental, complex behaviors with little variation within a social group or organization. Behaviors can be routine, but may not be directly instrumental (that is, they don't physically 'do' anything). Among other things, rituals serve as a signal of belonging and seeking for legitimacy.
- **Anecdotes and Myths:** Stories explaining who we are and why we are in a certain way, which are circulating within social groups. The stories do not necessarily have to be true, but they tighten the bonds between members of the group.
- **Artifacts:** Human-made items that members of a group or organization feel are characteristic or explanatory of the collective, can serve as important cultural items. Artifacts include buildings, rooms, vehicles, uniforms, visual signs, and message boards. These can be associated with rank, landmarks, particularly technical skills and abilities and help in 'mapping' and defining the conceptual world.
- **Symbols and metaphors:** Communicate abstract concepts by the presentation and manipulation of visible objects and provide shared meanings to a culture. They can generate strong feelings.
- **Language:** Facilitates expression of ideas and enables communication with others in a more efficient way. Efficient communication in different managerial levels and with the public is crucial for a successful management of an emergency.
- **Values:** Are ideas of right and wrong, good or bad, desirable and undesirable, which help us to evaluate people, objects, and events and serve as guidelines for behavior.
- **Norms:** Behavioral expectations that are established in the form of rules or standards of conducts. Norms can be further classified into informal (folkways and mores) and formal (law). Folkways and mores create group patterns and behavior within a society, which because of group pressure are expected to be followed by community members.

Culture provides an identity to a community based on common language, values, norms, and symbols. Generational transmission of cultural components (knowledge, beliefs, values and norms) helps to preserve society's values for the future and helps to strengthen the sustainability further and identity of the society/community. The close link between the culture and the group can either make the culture an enormously stabilizing aspect for a society, or creator of conflicts and violence, when the group members act differently than the set cultural values of the group, or when acts of violence are normative within the group. Culture's linkage to livelihood patterns of a community is also strong and thus cultural factors can be useful in supporting resilience under economic, social and environmental challenges. Traditional knowledge that has been transferred down the generations can sometimes serve as useful survival guidelines. One such example is Italy. Italy has a long history of disasters, in particular earthquakes. Devastated areas are often isolated and rural vilages forced to make decisions and collaborate with non-professionals in the response of catastrophes. By a participatory culture, they have succeeded to integrate many and different actors despite differences in agendas in complex rescue work during time-critical circumstances. Mashiko et al. (2018) reported one such example (9):

"After the 2012 Emilia-Romagna earthquake, different local municipalities in the devastated areas devised new customs and opportunities with the local community, encouraging citizens to participate in the reconstruction process." "The regional law recognizes the importance of stakeholders' participation in

enhancing the effectiveness of the reconstruction plan, thanks to both the base of an active and engaged civil society and the institutionalization of a participatory approach at the regional governmental level.”

Relying on the participation of municipalities, the regional government launched a diverse approach to participation in different stages of the reconstruction process, including sharing information about reconstruction of the historical center with citizens and crafting a common vision for the future of urban cores and their territories. This participatory approach to the reconstruction planning process has encouraged the dynamic community engagement of not only the local administration, professionals and citizens but also of citizen groups and local associations established after the earthquake.

Culture is the glue that makes up a common identity between different individuals. This means that there are good reasons for determining which cultural phenomena and how they influence teams. Cultural phenomena take on specific values, which make people act in a different way than expected by outsiders. Crucially, most individuals feel that their culture is the norm and the right and proper way of doing things. The belief that one's culture is the only valid one is deeply embedded in human feelings and emotions. Individuals from different cultures may well interpret events in completely different ways, which can cause anything from mild disagreement to major clashes with members of other cultures (10). A disaster relief group will often enter a society that is composed of individuals who hold very different cultural standards and viewpoints among themselves and from the disaster relief teams. This means that something that might be 'right' or obvious to one party may be incomprehensible to the other. The neutral climate created by collaborating organizations is, therefore, of great importance.

An organization whose members bear a collective self-image to always be in the first ranks, act decisively and have a high level of competency, can find it difficult to stand aside and leave room for others. Such groups may feel that a show of superior skill and courage to impress their colleagues, members of other organizations and bypassing spectators is necessary. Such behavior can lead to capacity constraints and a situation where different action options are not examined, risk assessments are not carried out, and difficulties arise in interacting across organizational boundaries and can result in a distorted selectivity in the handling of incidents. Lee et al. (11) reports how he took part in an exercise on an airport where the airport fire service instructed the airport security staff to refuse admittance to the local fire service crew, which was coming to back them up, as was required by the airport response plan. The reason appeared to have been professional rivalry between the officers in charge. Lee et al. (11) comments on the situation (p 740):

“Sadly, this incident was politely ignored in the post exercise discussions since everyone knew the personalities concerned, but its effect on the trust between two organizations that should have worked together can readily be imagined. If a real incident occurred, this infantile behavior during training might lead directly to death or serious injury.”

Crisis organizations are mostly organized by and for men and may tend to nurture the 'stiff upper lip' culture. Local practices and beliefs are ignored in the 'stiff upper lip' culture, but they are undoubtedly present and a major factor in the success or failure of exercises. Crucially, even professional standards of disaster relief workers, which are considered central to good practice, may conflict with local practices and beliefs, putting the professionals into a situation of conflicting values. Going against local cultural practices can create conflict and major difficulties for disaster relief teams. To add to the difficulty, different professions in different countries also evolve into mini or sub-cultures of their own (12-14).

Thus, there are cultures of doctors, of nurses, of firefighters that will differ from one another, and could affect the ability of team members from different cultures and subcultures to work with one another. Cultural components such as beliefs, traditional knowledge, values, the behavior of a community/group, livelihood patterns etc., can influence the risk perception and the impact of disasters on community and individuals and

thus can act as a both positive and negative aspect for disaster risk reduction and management. It is, therefore, important to make strategies compatible with cultural aspects of the community in further strengthening community's coping capacity towards disasters. Furthermore, it is necessary to emphasize the need for an effective integration of local knowledge with appropriate scientific knowledge, in making the disaster-affected communities' resilience against disasters and their impacts (12-14). There are several reports indicating the influence of the cultural beliefs and traditions in the current COVID-19 pandemic regarding the implementation of public health strategies and vaccination (15-16). In some countries, the vaccination hesitancy has been reportedly high due to publics' traditional beliefs, with many left unvaccinated. Another cultural aspect of importance in the COVID-19 response is the practice of cremation. In some countries, cremation is still not an acceptable practice hence; there were mishaps with authorities when some families violate laws pertaining to this practice, which a sound and evidence-based measure.

Conclusion

Ongoing disasters are not limited to national borders. Disasters caused by nature affect several countries and regions simultaneously and influence the life of people from different nations with diverse cultural heritages. Clarifying concepts, identifying agendas and interpreting cultural behaviors are necessary factors to reduce the likelihood of poor communication and work difficulties between disaster teams from different countries, regions, and professions. On individual level, actor to actor, the emphasis is on cultural awareness, and skills to allow the actor to understand cultural issues. At higher levels, the emphasis is on cultural theory and training commanders to identify and deal with cultural issues in crisis work. Cultural factors are a mix of social values, religious beliefs, tradition, and attachment to a location. It is a "how we do here" or "the way of" a certain population, organization, profession, or group. Being familiar with all cultural aspects of disasters, pitfalls and solutions will increase the rate of success and collaboration among involved agencies and population in need. Consequently, the trust created will empower all local efforts to build a lasting resiliency.

Take-Home Messages

- Culture is a link or transition between individual and collective behavior. The knowledge on cultural influences on an organization or a group of people during disaster management can boost and enhance the relationship needed for a successful collaboration.
- Long lasting cultural influences induce a low willingness to change. Artifacts and behaviors play an important role for new and old members both socially and for acceptance into the team. Therefore, the implementation of some measures might be more difficult.

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Chapter 8

INCIDENT COMMAND SYSTEM AND DECISION-MAKING

Roberto Faccincani, Amir Khorram-Manesh

Summary

An Incident Command System (ICS) provides a standardized approach to managing incidents and special events, based on proven incident management practices. However, there is a limited use of ICS globally due to the lack of evaluation and research. Studies show that ICS is best suited for routine events with few organizations involved, less time pressure and good resource availability. Consequently, it may be less suitable in situations with multiagency involvement when some actors do not have similar structures, background or experiences. Nevertheless, several elements of ICS can be used in incident management systems globally subject to continuous evaluation and improvement. Simulation training might be an effective instrument to practice knowledge and skills in functions needed for a successful disaster response, including an effective leadership.

Introduction

The Incident Command System (ICS), developed in California in the beginning of the 1970s, addresses the identified shortcomings in communication and coordination observed during forest fire incidents. ICS defines incident response organizational concepts and structures and consists of procedures for managing personnel, facilities, equipment, and communications, throughout the lifecycle of an incident (1). Although ICS was originally designed for rescue services and forest fire incident, it grew to be used for all types of incidents and by other actors, and gradually spread outside California to become a part of the US National Incident Management System (NIMS) after the 9/11 terrorist attack (2-3). However, recent reviews reveal deficiencies in the evaluation, research and improvement of the system, and its ability to adapt to other context and conditions, such as in organizations with diverse culture.

Studies show that ICS is best suited for routine events with few organizations involved, less time pressure and good resource availability. Furthermore, ICS seems to be less suitable in situations when some responders do not have similar structure, which is the case in most mass casualty incidents and disasters. (4-7). Consequently, the hierarchical nature of ICS may not address the networking needs and multiagency approach that arises in the crisis management in other countries, outside the United States due to different conditions, working methods and areas of responsibility or interests (6). However, it is clear that ICS with its hierarchical structure, uniform terminology and resource management system, modular organization, systematic effort planning and span of control can create a predefined direction and possibly shortens the initial, chaotic phase of a response and allows the crisis management system to get on track faster (8-9).

In countries, such as Sweden, although not as clearly developed, formulated, described or spread over all rescue service actors, several aspects of ICS may already exist or it may meet several of the identified needs in the incident management system. Consequently, while the use of ICS needs to be thoroughly examined, particularly, regarding the context and conditions that prevail within any specific rescue service, to create a commitment and a willingness to use the system, different elements of ICS can still be used (8). The aim of this chapter is not to focus on ICS as the preferable system but to discuss about some aspects of ICS, i.e., command and control, communication, coordination, and collaboration that contribute to effective leadership and vital medical decision-making.

Factors influencing vital decision-making

Disasters/major incidents may occur suddenly or develop slowly and require crisis leadership (10). Leadership may be defined in different ways, which is not the focus of this chapter. However, the key concepts can be

said to consist of 1) influence and motivation; 2) followers and teams; 3) direction, and goals; and 4) cooperation and collaboration (9, 11-13). The opportunities for acting as a leader will appear at any time and to anyone who recognizes the possibility, is motivated, and chooses to become a leader (11-13).

Planning for management of any emergency requires risk and vulnerability analysis by which risks are identified, vulnerability to those risks is evaluated, and preventive measures are prepared to increase the grade of preparedness. Such a task needs well-established routines, channels for information sharing and communication, step-by-step education, and a larger workforce and multi-agency collaboration. One important factor in a successful collaboration is good leadership in both vertical and horizontal organizations (14). A leader needs a reliable command-and-control structure to enable analysis and distribution of accurate information through a valid communication channel between coordinated organizations, and to ease the collaboration and decision making for optimal continuity of the management process. Accordingly, a leader should have the intellectual ability to understand, analyze, and evaluate available information, the executive capability of decision-making, the emotional awareness to weigh decisions against future consequences, and the motivation to enhance other staff capability while collaborating and aiming at the same goal (9, 14).

Command, control, communication, collaboration, and coordination (5C)

The ability to establish command and control (C2) is one of the most significant steps, which not only governs leads responding agency but also has a major role in collaboration and cooperation with other involved organizations (14-15). The primary task of C2 is to identify the incident and the needs and to initiate the entire response chain based on unconfirmed, sometimes missing and contradicting information. Consequently, members of C2 group should be trained in leadership and decision-making, including the difficulties and pitfalls that an incident can be associated with (14, 16-19). C2 function facilitates effectiveness and efficiency of action. The role of the commander-controller-coordinator is not to directly manage the incident (hand on operational tasks), but to allow those who work to do so to the best of their ability (vertical leadership), while the controller takes care of the direction and optimization of resources, including collaboration and cooperation of the different agencies on the ground (horizontal leadership).

Probably, the most challenging leadership task that arises is the need to declare a major incident, which in turn exposes the leadership to medical and non-medical consequences of their decision-making translated in mortality and morbidity. The functionality and the quality of C2, and the decisions made are dependent on how well policies and decisions are communicated and how the whole process of collaboration and coordination are performed (C3) (20-22). These are all described in other chapters of this handbook but will be shortly mentioned as the foundation of crisis decision-making that impacts the outcome of each emergency and disaster.

Decision-making

Right decisions at the right time will save lives in emergencies and disasters. The ability to make decisions is one of the most important features of an effective leader, which may depend on personal characteristics and experience of the leaders but also how followers comprehend the decisions made (9, 22). A review of the relevant literature indicates that difficult decisions should be made during disasters and emergencies, which might deal with situation assessment, resource distribution, triage, treatment, transport and safety of victims and staff, which requires reliable communication system to receive available information, to assess the situation, to make a decision and to transfer decisions made to enhance collaboration and coordination among involved organizations (14, 20-21). Such an experience for a leader can either be achieved by taking part in real events or training using validated programs (22-23). In addition, these often ethically sensitive decisions require motivation to improve as a leader by the potential leaders themselves (11-12, 16-17). To become a more effective leader, candidates should recognize the need for learning from others since success and mistakes committed by others, especially respected leaders, develop and improve individual leadership. Secondly, they need to study the work of experts and leaders in other areas, and be available for continuous

assessment. Finally, potential leaders should practice deliberately, and all lessons learned should be put into practice [13].

The core values of leadership are commitment, respect, empathy, vision, empowerment and development, communication, reinforcement and influence, humility, patience, resilience, honesty and transparency, accountability, and integrity. It is logical to believe that some of these values should be addressed early in life, while the others may be gained or enhanced through courses, exercises, programs, etc. (9, 13, 16) These characteristics will also enhance the readiness to understand the purpose of a common goal and the need for collaboration. The latter will, in turn, stimulate the possibility of learning civility and the need for change. Having said that, a designed program should bring out the individual core values of a person to enhance and strengthen the group and community values. Simulation exercises seem to be effective in these respects. Engagement with a multidisciplinary group of professionals is also fruitful, as they enhance the individual and group knowledge, skills, and competency and can be used to educate both youths and adults (18-19, 22).

In a crisis, the leader must confront and close the gaps between its organization's values, its behaviors and its realities. This may require the organization to endure a period of significant and adaptive change. In this situation, it becomes critically important that the leader communicates, in every way possible, the reason to sacrifice.

Conclusions

Often the magnitude and unpredictability of disasters are used as excuses for unpreparedness. Planning, establishing a clear chain of command, control and coordination and applying leadership and decision-making are the keys to success in response to emergencies and disasters. These actions/abilities may be related to the individual's characteristics, personality, attitude, and experience but can also be learned by training. Qualified leadership is a necessity in management of all emergencies. However, it is dependent on other elements of ICS, such as command and control, communication, collaboration, and coordination to attain the necessary assessment of the incident as the foundation for reliable decision-making. ICS may not be implementable in all countries, but its core elements should be implemented and adopted to each country's response plans.

Take-Home Messages

- Incident Command System provides a standardized approach to managing incidents and special events, based on proven incident management practices.
- Planning for all phases of an emergency is essential to overcome its medical and non-medical consequences. Failure in planning is planning to fail.
- Command, control, communication, collaboration and coordination are all necessary components of an Incident Management System.
- Training and education are needed to keep disaster plans current and to increase knowledge and skills in leadership and decision-making.

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Chapter 9

INFORMATION COLLECTING AND SHARING

Amir Khorram-Manesh, Eric Carlström

Summary

One of the critical functions of a crisis management plan during Major Incidents (MI) and/or disasters is the process of information sharing. This process is fundamental for proper decision-making. During the entire disaster cycle, communication, cooperation, and a multi-agency approach need to be harmonized in order for the plan to remain cohesive and deliverable. Information sharing takes place both horizontally and vertically. From a multi-disciplinary perspective, complex systems are prone to errors.

To avoid these problems, data should be collected, analyzed, disseminated, and communicated in a simple and accurate manner to the right persons. In this way, not only do all agencies get the same information, but also collaborate in a better way, which in turn results in better decision-making about actions and resource distribution during disaster response (DR). The aim of this chapter is to prepare readers for active work in a multifaceted disaster response team; to learn about the information sharing process, its importance and meaning by providing examples of information processes which can be expected during disaster response; to learn about the controlled system of information distribution, how to transfer and share information between different emergency services, how to use proper information technology and how to use available information systems during disaster response.

Introduction

The 9/11 Commission Hearings emphasized the importance of information sharing by clearly pointing out the US governments' poor information sharing between agencies in the pre-event phase of the terrorist attack (1). During an emergency, timely and transparent production and dissemination of information generates trust and credibility. Information comes from many sources and reflects the multi-disciplinary nature of emergency and disaster response. There is a demand for timely and relevant information from all stakeholders, including the affected population (2-4). The challenges, however, are to demonstrate how communication and information management contributes to a more effective and timely response and ultimately translates to more lives saved during a disaster.

Communication and information sharing must also be recognized as key elements in mobilizing resources, stimulating solidarity and support, increasing visibility, and strengthening the position of humanitarian stakeholders and of the health sector. To do this, all necessary technical and human resources must be made available, as well as political backing from health and disaster management authorities. It is vital for disaster response teams to include specialists in communication and information management regularly. Communication measures and the responsible teams to implement them should not be improvised during an emergency; they require ongoing preparation and planning prior to a crisis (5-8).

Major disasters and emergencies bring chaos and confusion and since all typical government and bureaucratic procedures are upset, it will be difficult to obtain and deliver timely and accurate information in the first hours of a disaster will probably be neither readily available nor very reliable. At this stage, the main challenge is to ensure that the information is clear and reflects the most urgent needs of the affected population. The second challenge is to produce and update information regularly. Information management is successful to the extent that measures are planned for collection, production, and dissemination. High efficiency depends on the connection with the most reliable information sources before any disaster or emergency occurs, and understanding the procedures for exchanging information with these sources.

To improve understanding of the impacts of a disaster or emergency on the population, communication specialists should have ready access to risk maps and vulnerability studies, population statistics, socio-economic indicators, historical data, and information on previous disasters in order to make the most accurate data available to the international community, national authorities, and other relevant stakeholders, including media. They all need to know the impact of the event and the needs of the population. Many agencies send their own personnel to the disaster site to gain first-hand information. Available and trustworthy data may reduce the need for this individual data collection (1, 7-10).

A disaster scene is not a place where training on information sharing should take place. Adequate information sharing between different emergency organizations involved in the management of the disaster is critical to the success and training and should take place in the prevention phase, as a successful response requires significant training and interactions. Decision makers in positions at different levels (strategic, tactical, and operational) need the right information at the right time to make the right decision during disasters. A large volume of information needs to be shared among different emergency agencies for successful management of disaster response (4, 11). For example, proper safety management requires careful consideration of the following (1-4):

1. Information about the hazard environment. What kind of hazards are present, what are the safety measures and what should be taken to improve it and how is the information being shared between different emergency organizations?
2. Information on the responder workforce. Decision makers should know who is involved in a DR and what their role is.
3. Information on present safety issues. Decision makers need to get the right information at the right time about injuries among first responders to be able to act on safety measures to protect all involved staff.
4. Information on safety equipment. Standardization of equipment if possible should be done in a preparation phase to avoid having a large number of different types of equipment coming to the scene from different sources, which may not be inter-operable.
5. Information about the information sharing process. Timely information about proper communication and information sharing should be available and brought up to the right level in the right amount and quality. The strategic command level does not need all the information essential for the operational level staff but needs timely information to manage the entire disaster response.

When a disaster occurs, there is a continuous tension between the time needed to understand a complex scenario and the urgent need for an emergency response. Usually, presenting more information than necessary raises the need for channeling and coordinating the information process. The main goal is to get relevant information on time to the right decision makers. The process of information sharing belongs to the domain of communication and is recognized by the IFRC as one of the three primary issues in coordination (other two are collaboration and joint strategic planning) (12).

Utilization of an early warning and alert system contributes to the timely and effective provision of information and results in an effective, but not always definitive, response. For example, within the EU, proper use of the Common Emergency Communication and Information System (CECIS) facilitates communication between the European Response Centre (ERC) with National Authorities and enables a more effective and quicker response to disasters for all involved organizations (5-7). This process is done by:

- Enabling information sharing on civil protection preparedness and response to relevant organizations,
- Improving coordination at the strategic level (matching the needs and resources, identifying gaps in assistance and searching for solutions) and the operational level (deployment of EU civil protection experts for assessment and coordination, if required),

- Coordinating assistance between offering and required states, CECIS helps save resources, time, and lives.

Conclusion

Lessons learned from the past indicate that practicing information sharing and awareness of its pitfalls are crucial. Information overload occurs when the amount of input to a system exceeds its processing capacity and consequently results in a reduction in decision quality. Information technology may be a primary reason for information overload due to its ability to produce more information more quickly and to disseminate this information to a wider audience than ever before. Generally, there are some principles and standards for communication and information management that should be upheld throughout an event. Information should be

- Accessible to all actors
- Easy-to-use
- Provided in understandable language
- Widely available through a variety of online and offline distribution channels, including the media
- Inclusive, i.e. its management and exchange should be based on a system of collaboration, partnership, and sharing by multiple stakeholders, especially representatives of the affected population
- Facilitate interoperability, i.e. all shareable data and information should be made available in formats that can be easily retrieved, shared, and used by all agencies
- Accountable, i.e. users must be able to evaluate the reliability and credibility of data and information by knowing its source
- Verifiable, i.e. accurate, consistent, and based on sound methods, validated by external sources, and analyzed within the proper contextual framework
- Relevant, i.e. should be practical, flexible, responsive, and driven by operational and decision-making needs throughout all phases of a crisis
- Objective, i.e. offer varied and balanced perspectives for addressing problems and recommending solutions
- Follow the principles of humanity, i.e. it should never be used to distort, to mislead, or to cause harm to victims or at-risk populations and should respect the dignity of victims
- Timely, i.e. it should be collected, analyzed, and distributed efficiently, and must be kept up-to-date
- Sustainable, i.e. information and data should be preserved, cataloged, and archived so that it can be recovered for future use in areas such as preparedness, analysis, lessons learned, and evaluation

Take-Home Messages

- Knowledge about the information sharing process and its definition, the controlled system of information distribution, and how to transfer and share information between different emergency services are essential during disaster response.
- Knowledge about utilization of proper information technology and available information systems, and identifying pros and cons and all pitfalls that may endanger the outcome of disaster and emergency management are crucial during disaster response.

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Chapter 10

LOGISTICS

Robert (Bob) Dobson, Amir Khorram-Manesh

Summary

Efficient logistics operations are of paramount importance in disaster-affected situations since many lives depend on it. In order to have efficient logistics operations in a disaster situation, many decisions have to be taken in real time or in response to the latest information. Logistics is an essential component of emergency response plans at both state and national levels to ensure the availability of the right commodity at the right location at the right time and in the right quantities. Logistics planning for a disaster requires knowledge of geographic, social, political, and physical characteristics of the region. In general, logistics planning addresses the following questions: 1) The type and quantity of resources needed, and the ways they can be procured, 2) The ways these resources can be transported to affected areas, 3) Which teams and who are taking part in the operation, and 4) How the coordination is achieved between different teams. These questions can be addressed if strategic resources for logistic support through utilization of the following methods are available: 1) Analyzing the capacity of the transport infrastructure to move supplies; 2) Finding potential sites for logistic hubs and distribution centers; 3) Assessing the capacity of the ports and airports and their ability to handle emergency operations under different conditions; 4) Analyzing government policies, plans, and preparation for logistic support.

Introduction

The number of disasters and public health emergencies worldwide, as well as the number of people affected by them, is growing (1). Logistics plays a central role in all phases of disaster management and supporting humanitarian operations. The fundamental task of a logistics system is to deliver the appropriate supplies, in an acceptable quality and in the right amounts to the locations at the time when they are needed. However, due to the inherent nature of disasters, humanitarian logistics are faced with unique challenges. Critical infrastructure, including transportation and communication systems, may have been severely affected and their functionality compromised (2). There is often a short window of time in which critical supplies and products need to be delivered to deter loss of life and prevent human suffering. Logistics is presently one of the most complicated components of relief efforts. Improvement of emergency logistics through better preparedness results in optimization of the overall humanitarian relief mission (2-6).

Emergency services staff need to acquire the knowledge, skills, and abilities necessary to perform logistical support at a disaster site. Keeping an all-risk environment in mind, this chapter discusses the essential requirements of providing support, resupply, transportation, sustenance and maintenance of a department's equipment and personnel and helps to attain a general knowledge of the field of logistics engineering, including common terminology, conventions, techniques, and standards.

Logistics on a Global Scale

Logistics on a global scale can be particularly difficult, especially when dealing with areas that are also in conflict. Contingency planning and intelligence regarding local issues is vital, as is a balanced approach by those countries responding to a disaster. Trust from the impacted country of the disaster plays a major part at the initial stage of the assistance given by other countries. Short-term and long-term planning should be an automatic consideration (7-9). Other considerations prior to any disaster response should prompt the following questions:

- 1) What are the realistic risks and threats?
- 2) What are the risks and threats to the supply chain i.e. time, distance, terrain and weather conditions?
- 3) What are the cultural differences or potential issues?
- 4) What is the political willpower from both the affected country and responding countries perspective?
- 5) What are the cross border agreements and arrangements already in place?
- 6) What documentation is required?
- 7) What are the risk and threats of security to the supply chain and personnel on the ground?
- 8) What are the quality control arrangements to ensure the type and standard of equipment?

The aim will always be to get help to those most in need. To do so, the primary objective is to have the knowledge and orientation of basic logistics. This covers a broad area encompassing teamwork within an organization, including distribution of duties, responsibilities, and mandates (10). There must be good knowledge regarding Facilities Unit, Supply Unit, Ground Support, Food Unit, Medical Unit, and Hazardous Materials awareness. Field exercises are necessary to provide experience for workers in each function and to improve collaboration and teamwork with other agencies.

For the organization, it is especially crucial to have trained staff capable of creating preparedness plans, which introduce and discuss relief logistics, its structure, and organization and describe all stages in logistics preparedness, including terminology associated with logistics. The organization should also have a clear development policy, and basic ethical guidelines to guide logistics operations (11-15).

A qualified and skilled logistician should have adequate knowledge to perform rapid needs assessments in emergencies, emergency procurement, overland operations and fleet management, and air operations. Logistics staff should be able to define and analyze logistics from a systems engineering perspective and integrate logistics planning and management into the systems engineering approach, process, and methods.

A system engineer integrates all support considerations of systems and equipment by conducting the following: design and development, testing and evaluation, production and/or construction, operation, maintenance, and finally recycling or disposal. The discipline of system engineering defines and influences the supporting infrastructure for included systems and equipment, such as maintenance, staff, facilities, supporting equipment and information/data. The practice of logistics engineering improves by conducting a repeated analysis and studies to optimize costs and system, logistics and performance requirements (12-15).

Supply chain optimization techniques integration, knowledge about impacts of technology on logistics engineering, including discussion of selected technologies, and estimation of death and injury, displaced population, and emergency goods, are other important considerations for a skilled logistician in disaster response (12-15). Developing new technologies, such as Geographic Information System (GIS), supports and enhances logistics planning and ensures the implementation of diverse measures to maintain an appropriate and functional logistics system (16-17).

Conclusion

Logistics is an essential component of emergency response at both state and national levels to ensure the availability of the right supplies in the right location at the right time and in the right quantities. Logistics planning for a disaster requires knowledge of geographic, social, political, and physical characteristics of the region. It is important to acquire knowledge about the type and quantity of resources needed, the ways they can be procured, transported, and the way the mission can be coordinated with other partners in affected areas. Proper analysis of the capacity of the transport infrastructure to move supplies, potential sites for logistic hubs and distribution centers, assessment of the capacity of the ports and airports and their ability to handle

emergency operations under different conditions, and government policies, plans, and preparation for logistic support are of significant value for logistic planning.

Keeping an all-risk environment in mind, disaster-trained logisticians are needed with specialized knowledge, skills, and abilities to perform logistical support at a disaster site. This chapter provided an overview of the field of logistics and discussed the unique challenges and prospective solutions associated with humanitarian logistics in emergency mitigation and preparedness, disaster response, and recovery.

Take-Home Messages

- Effective disaster response requires a general knowledge of the field of logistics engineering, including common terminology, conventions, techniques, and standards.
- Disaster trained logisticians should be used whenever possible for optimum supply chain functioning.
- Emergency services staff should be prepared to apply systems engineering methods, techniques, and processes to the problems in the logistics domain.

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Chapter 11

COMMUNICATION ASPECTS IN DISASTERS

Robert (Bob) Dobson, Amir Khorram-Manesh

Summary

Various means of communication within the organization and with other stakeholders are one of the most important factors in the successful management of a disaster. Knowledge of risk communication, effective crisis communication principles, and recognizing potential ethical and legal problems for crisis communication managers are necessary. This chapter aims to enable an understanding of the impact a disaster situation has on baseline communications capabilities at the human, organizational, command, and technology layers. Furthermore, it also describes the understanding of and sensitivity to the unique requirements of communicating ongoing disaster risk to different stakeholders, including responders, caregivers, the local and national media, and the public. Knowledge of communication expectations in existing local, national, and state response plans for disasters in particular, including political realities and technical capabilities, and the ability to synthesize all of that communications knowledge into actionable recommendations for organizations that need to respond to disasters, are other important parts of this chapter.

Introduction

Communication within an organization vertically and horizontally and with other partners is a vital part of capacity building and disaster risk reduction (1-2). Disaster teams communicate for a better understanding of the risk among public and authorities, to collaborate in the prevention of the risk, to make politicians and policy-makers willing to take precautionary actions, to warn and during the crises to limit the negative effects of the event. In other words, communication is a part of the challenge before, during and after an event. Communication is an essential tool for employees at all levels in the society, from global organizations to local, and in public agencies as well as NGO's and business.

In an emergency situation/disaster, accurate information should be communicated to the appropriate recipient. Effective and accurate decision-making is very much dependent on a functional communication system, but also a common language to ensure that everyone has the same picture of what is going on. Communication to the victims' families and the public is also important and, when used properly, can save lives (1-5).

Basic communication model

Basic principles of good communication are the same regardless of the topic communicated in a given program/activity. Thus, questions about the target group, the aim of the activity or frame are as relevant in risk- or crisis communication as ever, even though, there are some added challenges in risk communication and crises communication, respectively. There are many basic models for the planning of communication, however, whatever the model, the main principle is to start by asking the purpose of a message and what we would like to achieve by sending the message and what is the point? This is obviously related to who are the target groups, and thus, the groups' structure, its previous experience and knowledge and interests are important details to add when formulating a message. The next step is to use a valid tool or channel, which directly links the message to the availability of an instrument, device or system.

To plan communication, it starts with basic questions about aim/goal of the activity, core message, and target group. If the goals are formulated in terms of what you want the target group to think, feel or do, the activity is easier to evaluate and possibly more powerful. Often the target group is "the public", but to be able to adjust the activity to fit the target group it is necessary to find a more narrow or precise group to address. Another important issue is how much dialogue is needed to achieve the goals. In the broad sense, communication embraces both information activities with a person transmitting a message without any possibility to respond

(traditional media, textbooks etc.) and a dialogue where the transmitter involves the receiver in the process (social media, group discussions etc.). Three important parts of the communication planning are responsibilities, timeframes, and evaluation. As in all work, it is, of course, necessary to make clear who is doing what and when it should be done and the question of how the project will be evaluated need to be already considered in the planning stage (4, 6-7).

Risk communication

When defining risk communication, major recurring elements are communication about the hazard, vulnerability, precautionary measures and/or response to them. Also, opinions about and emotions related to the risk may be involved. Thus, an important element is a focus on the risk itself. Both the one-way process of information from a transmitter to receiver and the social interaction in mutual understanding or exchange of knowledge are a part of risk communication. Studies suggest that dialogue and social interaction, are specifically important in contrast to the earlier understanding of risk communication, which was that the authorities transmitted information to the public efficiently. Characteristics of good risk communications are action advice (people need to know what to do) and consistency of the message. Some major challenges in risk communication are (4, 6-10):

- 1) The importance of trust between the persons and organizations involved. Even though, experts and authorities in many countries are poorly trusted.
- 2) People are not passive receivers of information but actively seek and select information. They choose channels, organizations, and persons to trust and listen to, and form an individual perception of the event only partly based on the information supplied. People do not act rationally because of received risk communication. Feelings such as fear may control their actions.
- 3) The necessity of dialogue. There are many arguments that two-way communication is needed; first seeking mutual understanding is a way to build up trust between people. Second dialogue is shown to be more effective in changing behavior.
- 4) The importance of understanding risk perception. The perception of risk differs between people and this difference must be considered in analyzing the target group. Do we want to address those who perceive the event as a low risk even in a high-risk scenario or the persons whose assessment magnifies the risk? Factors influencing risk perception are personal attitudes, group norms, values in the community, socio-demographic factors, sense of control and personality.
- 5) Changes in media. With social media, risk communication is not only two-way but multi-directional. This provides positive effects such as possibilities to get information from diverse stakeholders during crises, a well-informed public, and rapid response in case of crisis, but it also brings new problems as misunderstandings spread quickly.

Channels for communication during crises: Media

During a disaster, the media provides prompt, first-hand coverage of the situation. The media's ability to influence international humanitarian assistance is well-known. However, it can also influence the course of management by serving as a critical partner to facilitate the transmission of messages that can generate humanitarian assistance, inform public behavior, and contribute to improving the quality of life in these circumstances. The media can also act as an instrument of criticism and scrutiny in situations where there have been irregularities, lack of transparency, or irresponsible management of assigned resources and emergencies. This, in turn, creates public demand for accountability of resources for actions taken during a crisis.

In emergency and disaster situations, the media will both demand and provide information. To strengthen partnerships between the media and disaster managers during an emergency, it is critical to understand the media's structure, main characteristics, accessibility, and its advantages and disadvantages before an event. Its

presence and credibility give visibility to all stakeholders. Mass media should be viewed as important allies. To ensure a successful relationship with media, planning, understanding, trust, and credibility are necessary before, during, and after the emergency (12-13).

Television: Typically provides national coverage but is based on imagery and as such broadcasters require images or video films. Images and videos should be prepared and delivered for broadcasting or accessed through a website. The material recorded for television should respect, at all times, the personal dignity of the subjects. To ensure correct coverage, one must meet television's demands for brevity and timeliness; if not, pieces will be edited by the television station and the message altered.

Radio: Provides immediate information over wide areas and can be accessed by a large population. It facilitates communication particularly with illiterate populations, production costs are less than television, it is effective in reaching global audiences, and after the Internet, is the medium that offers the most interactivity for its users.

Print media: Supports best the publication of in-depth reports and analyses of conditions leading up to and after the emergency. They generally have wide circulation, provide daily information for diverse audiences, and let people read and re-read the information, privately or publicly, reaching an even larger audience.

International news agencies: The role of news agencies during disasters is closely tied to the media outlets that purchase information from them. The output of news agencies will reflect the advantages, disadvantages, and roles that characterize their clients, whether print, radio, or television.

Computer-based media: Offers an extremely effective means of communicating with all stakeholders, the public in the affected area and the national and international public. They have multimedia features, can provide instantaneous coverage on a global scale, and have a nearly limitless capacity to store information. Interactive formats, such as chat rooms and blogs, assist in maintaining transparency and accountability. A disadvantage is that affected populations may not have access to the Internet, particularly during disasters.

Monitoring media coverage: It is vital to follow up on the messages that are circulated in the media by either hiring companies that monitor all of the media outlets or using search or news alert services that are offered by the Internet. Putting a simple well-organized monitoring system into place allows channeling information more strategically, assists authorities in making decisions, which affect various stakeholders' responses, and allows identification of topics that receive more or less coverage, and adjust the emphasis in messages as necessary.

Live examples of Communication

Communication during a crisis or major incident is critical to the success of saving lives. In some countries, hospitals work in *known* clusters and this aids any mass casualty response. The fact that they know each other and the capabilities of each hospital means that they can be more effective at the time of the greatest need. Transfers between hospitals can be achieved quicker as "key players" already know each other. The time to start inter-hospital relationships is *before* the incident and not during the incident.

To illustrate effective communication, consider the following example. At 6 pm on 4 August 2020 an explosion happened in the Port of Beirut, 200 people died and over 7000 were injured. The four major hospitals in the center of Beirut were affected, one of the hospitals was severely damaged by the blast itself and had to be evacuated. Due to the success of the communication between the hospitals, many lives were undoubtedly saved, including transferring non-blast patients, such as newborn babies, very quickly between hospitals. In this case, medical and administration staff communicated effectively with their counterparts in the affected hospitals. Very often key decision makers practice their own Major Incident Plan in isolation and this could result in delays in liaisons between hospitals and ultimately cost lives (14).

Information from the Scene

Due to many years of the Irish Republican Army (IRA) attacks resulting in explosions in London, England, a system of Hospital Liaison Officers (HLO) was developed. As soon as an explosion or other mass-casualty event occurs, HLO's are deployed to the emergency departments (EDs) across London. The HLO's are Officers from the ambulance service who are listening to "real time" radio communications from the scene. Any relevant information, such as numbers of casualties, types of injuries and approximate arrival times can then be relayed directly to the waiting hospital staff. In the case of multiple sites, real time up-dates can also be given and this could include details of the other designated hospitals that are responding to the incident. Intelligence can also be gained including details of current hospital status and if the hospital is over or overwhelmed, thus preventing too many casualties arriving at one hospital whilst another hospital is receiving very few (15).

Although most EDs use the media (television) for most of the up-dates, the media coverage is not always reliable. It could be hours before the media receives the "official" stand down. A key role of the HLO's is to report current status from the scene, such as the last remaining casualties on scene could be vital information for hospital staff and surgeons who will still be making triage decisions. Timely information that the scene is clear could mean the difference to a surgeon starting an operation or not.

Media interviews

After any mass casualty event, the focus of public interest moves from the scene to the hospitals. It is advisable that only those staff trained in media interviews should be the ones that present on television or radio. Ideally, in most organizations a designated public information officer (PIO) who is trained in media communications will facilitate this role. Interviews of witnesses or victims with minor injuries from the scene will always occur. Unintentional comments can lead to misunderstandings, especially when dealing with a mass casualty event potentially caused by terrorism. Most early interviews after a terror attack consist of confirming that an incident has occurred and that the emergency services are working very hard. It could also include information advising members of the public to stay inside their homes or not to travel into a particular area. Sharing information about precise numbers or potential reasons for the attack should be avoided. Often premature "leaks" can give a false impression and can be inaccurate or dangerous. Comments about race, religion or reason could inadvertently put innocent members into the public risk (16).

Conclusion

Various means of communication within the organization and with other stakeholders are one of the most important factors in the successful management of a disaster. Knowledge of risk communication, issue management, effective crisis communication principles, and recognizing potential ethical and legal problems for crisis communication managers, are necessary.

Take-Home Messages

- Disaster situations influence the baseline communications capabilities at the human, organizational, command, and technology layers.
- Disaster leaders need to be sensitive to the unique requirements of communicating ongoing disaster risk to different stakeholders, including responders, caregivers, the local and national media, and the public.
- There is a required knowledge of communication expectations in all existing response plans for disasters in particular, including political realities and technical capabilities, and the ability to synthesize all that communications knowledge into actionable recommendations for organizations, responding to disasters.

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Chapter 12

GEOSPATIAL SUPPORT

Jan Haas

Summary

Geospatial data plays an essential role in disaster risk management. When a disaster occurs, emergency responders can get an overall picture of the cause, time, and the location of the disaster, its characteristics extent and severity of damages based on the analysis of pre- and post-disaster data. Official geodata from national authorities, space- or airborne remotely sensed data alongside crowd-sourced and Volunteered Geographic Information (VGI) can also be used to make informed decisions and plan actions for disaster prevention and mitigation measures as well as for recovery and reconstruction. The aim of this chapter is to explain basic principles and practical implications of cartography, remote sensing and Geographical Information Systems (GIS).

Introduction

A good situational understanding and localization of assets, as well as technical communication between the headquarter and the field, are crucial elements of effective disaster operations. Most relevant information is geocoded and has to be handled via technical devices, such as satellite phones or internet communication. In recent years, remote sensing has gained more and more attention in disaster management applications. Meanwhile, there is a large and growing variety of remotely sensed imagery available allowing for timely acquisition of data and a new generation of disasters maps (1-3). Satellite and aerial imagery provides users with an overview of an area affected by a disaster and allows field staff to orientate themselves in the field. Image coverage can range from global to a few hundred meters with spatial image resolutions varying from cm to km level. Knowledge about image sensors and data sources and availability is important in order to choose the right data. In addition to space- and airborne imagery, the fast development of Unmanned Aerial Vehicles (UAVs) and their use in different domains opens a new paradigm for their contribution in disaster management. Recently the development and spread of mobile communication devices with built-in GPS enable users to capture additional information enriched with data on time and location. Furthermore, these devices allow for precise navigation for staff in the field (4-9).

Other chapters of this book cover communication aspects with respect to planning, human elements of communication and information sharing between users in the disaster response phase, as this is a very important element in disaster response. As disaster management is a task that involves people in different locations, recent communication technologies ought to be used to allow for real-time communication. With the arrival of mobile devices, the use of geographical information is more common by nearly everyone on a daily basis. Furthermore, the spread of social media for disaster management opens up the potential for a vast amount of crowd-sourced data that can be used for collaborative mapping. Nevertheless, when it comes to disaster management, critical situations require knowledge of standards, concepts, potential and limitations of the use of geodata. Relevant references concerning cartography, GIS and remote sensing are included in the reference list at the end of this chapter (9-15).

Integrated systems, such as the Copernicus Emergency Management Service (EMS), provides actors involved in the management of disasters caused by nature, human-induced emergencies, and humanitarian crises with timely and accurate geospatial information derived from satellite imagery, complemented by available in-situ and open-source data. The EMS responds to national and cross-border disasters in Europe and large-scale disasters outside of the EU and offers various services to national authorities dealing with disaster risk management: early warning as well as rapid risk and recovery mapping (1-2).

Maps based on remotely sensed data can be very useful to support prevention and preparedness activities. After catastrophic events such as earthquakes, tsunamis, floods, severe storms, forest fires as well as humanitarian crises, EMS, UAVs and a number of collaborative mapping technologies can deliver emergency response maps and analyses within a few hours. One main advantage of remote sensing technology is seen in its timely, continuous and efficient data acquisition over larger and dangerous or life-threatening areas. Thus, the EMS rapidly acquires and processes pre- and post-event satellite imagery and analyzes them together with other geospatial data. These resulting maps can provide an assessment of damage impact caused by a disaster, which in turn can help first responders to prioritize intervention actions. Satellite, aerial and UAV images can help to plan post-disaster recovery and reconstruction initiatives. By comparing satellite images taken at different intervals, they can also help to monitor the progress of reconstruction and recovery projects (4, 8, 13-15).

Conclusion

Rapid technological advances in data acquisition, storage, analysis, dissemination and sharing lead to unprecedented possibilities to build systems for disaster mapping. National authorities, organizations, companies and political entities, such as the European Union, have such systems in place or develop them. Geospatial support in disaster management is essential in responding to and preparing for disasters caused by nature and public health emergencies that are expected to occur at higher frequencies and intensities in the future as a result of climate change and globalization.

Take-Home Messages

- Thoroughly check available data and systems before collecting/analyzing geodata on your own. Often, high quality data, maps and solutions are already at hand.
- Many solutions and data are web-based. A high-quality smartphone or tablet can be enough in the field.
- Among the numerous systems for data acquisition, analysis and sharing, get familiar with one system. There are open-source solutions but a subscription to a comprehensive commercial system, e.g. ESRI (Environmental Systems Research Institute) might be worth it.

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Chapter 13

SEARCH AND RESCUE (SAR)

Riccardo Stucchi, Roberto Faccincani

Summary

The term Search and Rescue (SAR) refers to a variety of actions from rescuing and extracting victims and casualties from collapsed buildings and structures to rescuing persons trapped in water, fire, mountains, caves, etc. SAR is one of the most important and dynamic processes in disaster management, which aims to identify and rescue lives in jeopardy. Security and safety should always be considered for both responders and victims. The aim of this chapter is to describe SAR procedures and organization in disaster response management. The reader will learn concepts about risk reduction, SAR programs, USAR (Urban Search and Rescue) mission, safety and security, USAR teams classification, knowledge needed at different management levels, international USAR response entities, and ethical aspects.

Introduction

Effective disaster management and response is often predicated by the affected Nation's ability to cope and to limit the consequences of the disaster and in managing any international assistance, which has been requested and accepted. One specific variable heavily influences SAR efforts: the type of disaster. Depending on the type of hazard, disasters can be classified in several ways (see chapter 1). For the purpose of this chapter, we can divide disasters into the following (1):

1. Disasters caused by nature (e.g., earthquakes, wildfires, floods, extreme heat, etc.)
2. Man-made disasters, which can be;
 - a. Technological (e.g., hazardous material spill, nuclear power plant accident)
 - b. Intentional (terrorism using chemical, biological, radiological, nuclear substances, or explosives).

Search and Rescue “Program”

Establishing a SAR program to manage complex disasters provides a host nation with enhanced response capabilities. These may include a variety of actions from rescuing and extracting victims and casualties from collapsed buildings and structures to rescuing persons trapped in water, fire, mountains, caves, etc. (2-3). There are also a number of established international response capabilities to provide or increase national response to such disasters when assistance is sought by the affected country. Most countries have established bespoke legislation, regulation and response structures to facilitate the planning, preparation, response, and recovery from disasters. For example, the System's 28 USAR (Urban Search and Rescue) task forces can be deployed by FEMA (Federal Emergency Management Agency) to a disaster area to provide assistance in structural collapse rescue, or they may be pre-positioned when a major disaster threatens a community (4).

The international community has—through the United Nations (UN), the European Union (EU), the North Atlantic Treaty Organization (NATO) and other multilateral agreements—established protocols to provide and support SAR operations by request from the affected Country. The UN Office for the Coordination of Humanitarian Affairs (UNOCHA) provides guidance regarding USAR's capacities, capabilities and general structures (5). The International Search and Rescue Advisory Group (INSARAG) (6), whose activities are guided by United Nations General Assembly resolution 57/150 of 16 December 2002 on “Strengthening the Effectiveness and Coordination of International Urban Search and Rescue Assistance”, oversees this guidance. The INSARAG Hyogo Declaration adopted at the first INSARAG Global Meeting in 2010 in Kobe, Japan, also leads the activities.

USAR Missions

In the immediate aftermath of a disaster, needs are often greater than professional emergency services personnel can provide. In these instances, first responders become a vital link in the emergency service chain. Victims of disasters require rapid location identification, medical first aid, and rescue. Victims of a plane crash or a shipwreck, people buried by snow or trapped in the wreckage of their homes or places of work after a building collapse or an earthquake are in particular need. Although specialized dog teams and sophisticated listening devices are available to help search for trapped people, local first responders, such as fire, ambulance, and police personnel who are trained and certified in SAR, do the bulk of rescue work. The public often assists the first responders, but it takes more than just willing hands to save lives. Untrained, unorganized people may endanger themselves and those they are trying to rescue. USAR is often times a very complex operation, requiring highly specialized training. USAR operations are dangerous and pose significant risk for responders. Those wishing to assist should await the arrival of the first responders or specialized SAR teams and follow their instructions. USAR missions typically have three phases (6):

1. **Assessment:** Collecting facts about what types of structures are involved, the extent of damage, the layout of the building(s), hazards and what rescue personnel and equipment are required and already available. Structural damage is usually categorized as light, moderate, or heavy. Based on the assessment, a course of action is determined. Assessment is an ongoing process that continues through all phases of search and rescue operations; plans are modified as needed.
2. **Search:** Using search techniques focusing on the location of victims and areas of entrapment. Areas of entrapment inside damaged structures are called voids; they include spaces that victims get into to protect themselves (under desks, in bathtubs, in cupboards, etc.). When potential areas of entrapment have been identified and the potential number of victims estimated, search operations begin, using various systematic search patterns. Where many structures are damaged the exterior walls of buildings that have been searched are marked using INSARAG's building marking system.
3. **Rescue:** Trapped victims are removed and given medical aid as necessary. Triage may be used to prioritize assistance for those who need it most. Before removing victims, it is often necessary to move or stabilize debris. Victims may be able to walk to safety themselves or may be removed using lifts, drags, or carries. Removal of victims is designed to avoid further injury.

Safety and Security

Disaster rescue, by its very nature, is a high-risk activity. Safety must be foremost in mind. As such, it is important to communicate the location of the event and the number of people involved as well as every potential residual danger (collapsed structures, broken pipes, electric cables, etc.) to the authorities, thus allowing them to coordinate their rescue efforts efficiently (7). It is important to note that anyone entering an incident area should wonder whether or not the damage may be the result of a criminal act. If that possibility exists, it is of the utmost importance that the integrity of the crime scene is preserved to assist law enforcement officials in the prosecution of the criminals.

The goal of search and rescue operations in a disaster situation is to rescue the greatest number of casualties in the shortest amount of time, with minimum risk to the rescuers. In reality, this means extrication (rescue) in different locations and initial medical stabilization of casualties usually trapped in confined spaces. The majority of these operations are performed in urban areas. Besides structural collapse, other causes are transportation accidents, collapsed trenches etc. The causes of these emergencies could be slow progressing events (long pre-event phase), such as floods, hurricanes, or suddenly developed incidents (short pre-event phase), such as an earthquake, terrorist attacks, transport accidents. USAR is a multi-hazard discipline needed to perform in many varieties of disaster situations.

A Mass Rescue Operation (MRO) is a situation when the capabilities normally available for SAR are inadequate for immediate response due to a large number of casualties. MRO do not occur often but have major consequences. Preparedness is a function of critical importance for preventing large mortality and morbidity in MRO situations. Rescue teams work with other agencies during disaster response and proper education and training should be available to enable efficient multiagency approach and work. Planning cannot replace the need for education and training (8). SAR operations can be provided in a different environment with different types of risks. Risk management process should be included in every SAR operation. This continuous activity consists of:

- Identification of mission
- Identification of hazards
- Assessment of the risks
- Identifying options
- Evaluating risk vs gain, Perform decision, and Monitor situation.

The use of technology in SAR operations

In case of a disaster, the first priority is to rescue survivors quickly, particularly, if they have time-dependent injuries. To support first responders' SAR efforts, Unmanned Aerial Vehicles (UAV), robots and other technological tools are nowadays available and they can be used singly or in combination. A drone which can do large sweeps over disaster areas can help the first responders in locating victims in very extensive disasters (9). If the drone is equipped by a system to detect signals from the victims' mobile phones, this dramatically increases its capacity. Sensors of motion or vital functions (e.g., heat production), can avoid the focus on non-viable bodies. Artificial Intelligence (AI) can be used to guide drones to methodically survey the area and even estimate the trajectory of survivors who are moving, as well as to integrate all information through algorithms aimed to the maximum effectiveness (10). This, of course, also increases the safety of the first responders, avoiding them to enter risk areas where there are no signs of survivors.

For the same principles, remotely operated robots can be used to enter collapsed buildings or other dangerous places, like mined areas or sites of ongoing active shooting. These robots can be equipped by video-cameras, sensors and other technological tools to increase their capacity to help first responders as well as to protect them against danger. From 2015 to 2019, the EU funded project INACHUS (Technological and Methodological Solutions for **I**ntegrated **W**ide **A**rea **S**ituation Awareness & **S**urvivor **L**ocalisation to Support **S**earch and **R**escue Teams) and has been researching on how to establish an effective USAR operation framework to minimize the amount of time needed to locate victims, while also aiding rescuers in finding the safest and the most effective way to reach those victims (11).

Conclusions

The organization of SAR varies from one country to another. SAR is most often closely linked to the firefighting services. There is a further need for standardization of SAR procedures, especially if the SAR teams are deployed on international missions. Located at UN Secretariat, INSARAG was established in 1991 and publishes guidelines as a reference guide for international USAR operations for countries aiming to establish USAR capacity, as well as for established USAR teams. The purpose of these guidelines is to provide detailed recommendations based on the accumulation of institutional memory and experience related to international USAR response, as seen in the scope of the INSARAG mandate. UN General Assembly Resolution 57/150 (16 December 2002)—*Strengthening the Effectiveness and Coordination of International USAR assistance*—endorsed the use of the INSARAG Guidelines. In 1996, ECHO (European Commission Health Office) developed a specific program—DIPECHO (Disaster Preparedness ECHO)—to enable better preparedness for disasters worldwide. To support first responders' SAR efforts, Unmanned Aerial Vehicles

(UAV), robots and other technological tools are nowadays available and they can be used singly or in combination.

Take-Home Messages

- The initial response to disasters belongs to the affected community.
- Establishing national or international SAR programs enhances the capability of an affected community to respond to a disaster.
- Activities, rules and regulation of SAR missions should be standardized: this is the main task of the International Search and Rescue Advisory Group (INSARAG) established by the United Nations.
- INSARAG guidelines address: composition and dotation of SAR teams; phases and modalities of intervention; cultural awareness including respect of local traditions and general ethical principles.

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Chapter 14

PUBLIC HEALTH EDUCATION - AWARENESS OF DISASTER MANAGEMENT

Katarzyna Naylor, Amir Khorram-Manesh

Summary

Public health is the science of protecting the safety and improving the health of communities through education, policymaking and research for disease and injury prevention. Public health involves the application of many different disciplines, such as Biology, Anthropology, Public policy, Engineering, Education, Psychology, Computer science, Sociology, Medicine, Business, and others. This chapter focuses on public education and awareness. The latter is a prerequisite for disaster risk reduction and is achievable in different ways using different modalities, depending upon the intended effect and population involved. Campaigns, integrating knowledge into formal education, development of risk reduction training and capacity building, and establishing local disaster safety initiatives, are some of the methods that can be used. Principles and tools for effective implementation and evaluation of public education programs are necessary as well as strategies that ensure the quality of the designed program. This chapter shortly defines public health and describes how public awareness and participation in disaster planning and response help to minimize disaster effects.

Introduction

What is public health?

Public health focuses on preventing diseases and injuries on a larger scale than daily clinical work. Consequently, there is a need for close collaboration with communities and populations in order to find underlying causes and then implement innovative solutions (1). For example, in the increasing amounts of gun violence and shooting victims around the world, the public health perspective is not on wounds and surgical approaches, but rather on the causes of gun violence. Specific major public health foci vary from country to country, including problems such as premature or low birth-weight newborns, malnutrition, infectious diseases, etc. In all of these problems, the task of a public health worker is to investigate the factors that might cause these conditions and to develop programs to improve or totally abolish the conditions. The list of public health issues is long and the need for preventive measures much longer, depending upon the geographic location, living standards, etc. Today, public health encompasses areas as wide-ranging as epigenetics, chronic disease, the science of aging, mental health, disaster response, refugee health, injury prevention and tobacco control (1-2).

Disasters can be substantially mitigated by informed and motivated communities and in this public health is the key. Using knowledge, innovation, and education to build a culture of safety and resilience at all levels is one of the priorities for action for disaster risk reduction, as stated in the Hyôgo Framework for Action (3). One of the major issues of public health is the right to safe water and sanitation in peacetime as well as in emergencies. During disasters and emergencies, the available water, sanitation, and hygiene may not be adequate due to destroyed or damaged infrastructure (4). As a result, diseases are likely to occur. People affected by emergencies often suffer from malnourishment, stress, fatigue and other ailments, including injuries. These conditions, coupled with unsanitary living conditions, such as substandard sanitation, inadequate water supplies, and poor hygiene, make disaster-affected people especially vulnerable to diseases (2-4). These aspects call for an improved public health system since diseases related to water, sanitation, and hygiene are all controllable and preventable. In this perspective, the full participation of the community and volunteers are essential.

The need for professionals in Public Health

The need for the presence of community health workers and extended health workers during emergencies is undeniable. Substantial work can be accomplished at the community level for the prevention and early detection of problems and diseases. Experience has shown that wide-ranging benefits result when communities are actively involved in their own health and participate in water and sanitation projects under the guidance of professionals in public health. Such approaches give community members the opportunity to build and strengthen problem-solving skills, empower them to take action, and become involved in their own recovery process. Additionally, public health professionals can identify and strengthen the local skills and capacities that exist among the disaster-affected population. Strong community involvement is critical for projects being sustainable long after external assistance stops (5-6).

The methods to increase public awareness

Public awareness leading to disaster risk reduction, this can be achieved in different ways.

1. Campaigns: Traditionally, campaigns are one of the most common methods of informing the public. Such campaigns can be run in journals, magazines, and newspapers, or in the form of flyers. However, a common problem with this method is the high illiteracy rates in many countries, especially in developing countries. Several reports have indicated that people with lower health literacy have worse healthcare and poorer health outcomes since they do not possess the necessary skills to manage their health and participate in disease prevention actively (7). Previous studies in different parts of the world have shown that low or limited health literacy in the US, Southeast Asia, and the European Union are prevalent and consistently associated with several factors, such as education, ethnicity, and age. In Europe, one in every two Europeans may not be able to comprehend essential health-related information and materials (5, 7-8).

2. Formal education: To overcome the issues with health illiteracy, an increasingly common method of informing the population, even in high illiteracy societies, is to inform children and youths by integration of knowledge into formal education. Thereby, knowledge will spread to all families, irrespective of educational background (9-10).

3. Exercises and Training: Another method of dealing with public health issues is developing risk reduction training and capacity building. Scenario-based education not only identifies the weaknesses in a society but also improves the quality of disaster management and can be used in both adults and youth (11).

4. Local educational initiatives and programs: Another alternative is establishing local disaster safety initiatives or programs to engage the public in a common task. To achieve the desired outcomes, it is necessary to have or create principles and tools for effective implementation, monitoring, and evaluation of public education programs to ensure the quality of the designed programs (9, 11-12).

The role of modern technology

Modern technology provides educators with the opportunity to enhance the educational process in the area of public health. Additionally, convenience is augmented by the ubiquity of technology in public lives. The process of ensuring public health safety, education, and training at all levels of education remains a crucial issue (7-11). Often, translating current research evidence into practice becomes a slow, dull, and complex task. Although numerous efforts have been undertaken, there persists a significant gap between research evidence and its use. In the area of public health, efforts need to be undertaken to prevent the gap from widening, as the ramifications can be dramatic (e.g., patients may be bereaved of effective but novel treatments (13-15).

The teaching methods used remain a vital element of the educational process, both in terms of acquired skills, disseminating up-to-date knowledge and acquired competencies. Continuous development and introduction of

new didactic methods (e.g., medical simulation, videos, e-learning) to training programs in the area of public health should improve the effectiveness of the education process. Additionally, it can help participants better understand and practice skills that will later be used to save patients' lives. The changing landscape of public health education paves the way for methodological diversity in educational endeavors (14-18).

As an example, video-based learning engages the viewers' attention and addresses their expectations for a technologically modernized approach to education. Numerous studies have discussed the advantages of this repeatable form of education, considering the approach to be a supplementary resource for the public in developing their knowledge of public health and community disaster management (19-20). Major public health organizations implement the use of instructional videos when communicating with the public and healthcare professionals (21-22). There is a potential in this educational tool to educate the public and standardize proceedings in the medical environment, including disaster preparedness.

Conclusions

Key components necessary for the preparation of a community to combat emergencies are those of risk communication and community engagement strategies at the early stages. Preventive and emergency response strategies should be coordinated and strengthened at the community level by improving community resilience and through educational initiatives to increase community awareness (2, 23). The crucial steps in achieving a resilient and knowledgeable community are a transparent and trustful government–people relationship, improved health systems security proactivity, community to individual confinement, trust, and resilient solutions (2, 5). Furthermore, it is equally necessary that those working within the field of public health have the mandates, the knowledge and competences necessary to raise the public awareness. It is, thus, crucial to ensure that policies, mathematical models, and technological measures are developed and in place to protect the lives of the public, and initiate discussions regarding practical, psychological, and ethical challenges that influence future public health policy planning (5).

Take-Home Messages

- The implementation of public health strategies demands higher public health knowledge to recognize, accept, and deal with all restrictions and concerns.
- An integrated approach requires the combination of modern technology with up-to-date research to educate the public.

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Chapter 15

PUBLIC HEALTH ENGINEERING, SANITATION, AND HYGIENE

Lesley Gray, Carol MacDonald

Summary

In any disaster, people most impacted are often those with the least resources prior to the event. In low-income countries people affected by emergencies often suffer from malnourishment, stress, fatigue and other ailments including injuries and infections. These conditions, coupled with unsanitary living conditions, including substandard sanitation, inadequate water supplies, and poor hygiene, make disaster-affected people especially vulnerable to diseases. Provision of the basic supply of water, sanitation, vector control, etc., has a direct impact on disease control and should be included in the framework of disaster management strategies. For maximum impact, attention should be given not only to the technical aspect of public health engineering, but also to human behavior and to cultural aspects. All essential requirements should be considered with respect to the provision of sufficient potable water, the provision of adequate excreta disposal, wastewater, vector control, etc. The most appropriate public health engineering strategies will vary from place to place and over time, and have to be established in close cooperation with the total disaster management system.

Introduction

In the wake of a disaster, humanitarian actions are needed to protect the life and health of survivors with dignity, comfort and security. After a catastrophic disaster, such as an earthquake, many people may be displaced, making them susceptible to illness and death from disease, particularly diarrheal and infectious diseases (1). Water, sanitation and hygiene (WASH) is an important element in disaster preparedness and response and for preventing and mitigating the impacts of future disasters and health emergencies (2). WASH interventions are a key determinant for survival in the initial stages of a disaster and can yield significant health and social benefits for affected populations.

Emergency WASH programs are intended to provide rapid relief rather than long-term sustainable access (3). They aim to reduce public health risks by creating barriers along the main pathways by which pathogens infect humans (i.e. feces, fluids, fingers, flies and food) (1). The key activities of emergency WASH programs are:

- promoting good hygiene practices;
- providing safe drinking water;
- providing appropriate sanitation facilities;
- reducing environmental health risks; and
- ensuring conditions that allow people to live with good health, dignity, comfort and safety

In WASH programs, it is important to:

- manage the entire water chain: water sourcing, treatment, distribution, collection, household storage and consumption;
- manage the entire sanitation chain in an integrated manner;
- enable positive healthy behaviors; and
- ensure access to hygiene items

The vital roles that safely managed WASH services, including waste disposal, play in preventing and protecting human health during infectious disease outbreaks has been underscored by the COVID-19 pandemic (4-5). Hand hygiene, a vital part of the wider WASH framework, is strongly recommended by

WHO as a critical control measure against the spread of COVID-19. However, much of the world's population, primarily those in low-income countries, lack access to WASH facilities (6). Failures of emergency WASH programs to meet humanitarian or sectoral standards and the needs of those affected by crises have given rise to calls for a shift toward more resilient, durable and sustainable WASH interventions (7). Such failures also highlight the importance of engaging with communities to ensure that people affected by disasters have more control over the response and that any programs are designed to be fit-for-purpose and reflective of community needs, resources and preferences. Particular considerations include, among others, cultural taboos, physical accessibility and concerns for privacy and safety.

Key program design characteristics include simple programs that are community-driven, appropriately timed, and with linkages between relief and development. For example, practices, social norms and myths concerning the management of incontinence and menstrual hygiene should be considered when designing and delivering personal hygiene programs. In addition, some people may need different or greater quantities of personal hygiene items because of their age, health status, disability, mobility or incontinence (1). Factors that influence effectiveness of emergency WASH programs include trust/fear, taste and smell of treated water, methods of communication methods, and inaccurate perception of efficacy (3). Water needs and usage for drinking, hygiene and domestic use will vary within a community, and be influenced by pre-disaster use and habits, excreta containment design, cultural habits, religious practices and mobility barriers. These factors should also be taken into consideration when providing appropriate, safe, clean and reliable toilets, as uncontrolled human defecation is a high risk to health.

Public health engineering focuses on evaluating and managing environmental issues that have perceptible impacts on public health during disasters (8). Public health professionals, managers, and responders have a critical function in managing environmental public health impact during disasters by designing and delivering appropriate, effective WASH programs. This can only be achieved if managers and responders are adequately prepared and trained across all phases of the program cycle. This includes assessment and analysis, strategy development, planning and design, implementation and monitoring, and evaluation and learning (1-2, 7-10);

Assessment and analysis: To help to identify immediate needs and prioritize activities to address those needs, data is collected on the population, health, technical issues, physical environment, water storage, distribution, use, and socio-political context.

Strategy planning: Planning of responses to provide the right humanitarian assistance at the right time to those most in need. The full participation of the affected population and coordination with national and local authorities is essential to achieve this across all sectors. The key actions and indicators provide a framework to identify priorities, determine planning figures and coordinate across sectors. This helps to ensure that sectoral responses reinforce each other and support the population's own capacity to meet their needs. The key actions and indicators outline the quality of assistance that should be attained. They also provide a basis for conducting a response analysis that identifies the best way to meet identified needs and minimize potential harmful side effects.

Implementation: In some extreme disasters, quick implementation of the public health engineering plan is mandatory, since it is not possible to obtain all requirements desired without starting up an intervention. Document these issues and work actively with other sectors and the affected population to identify appropriate ways to minimize potential harm.

Monitoring and Evaluation: Monitoring, evaluation, accountability and learning (MEAL) supports timely and evidence-based management decisions. It allows humanitarian programs to adjust to changing contexts (Sphere). Evaluation supports learning to improve policy and future practice, and promotes accountability. MEAL systems also contribute to broader learning efforts related to effective humanitarian action.

Conclusions

Emergency WASH interventions should provide access to safe water and sanitation and promote good hygiene practices with dignity, comfort, and security. Particular considerations include, among others, cultural taboos, physical accessibility and concerns for privacy and safety. Practitioners should consider WASH in relation to access, equity and inclusion.

Take-Home Messages

- During disasters, all people should have safe and equitable access to a sufficient quantity of water for drinking, cooking, personal and domestic hygiene.
- People should have adequate numbers of toilets, sufficiently close to their dwellings, to allow them rapid, safe and acceptable access at all times of the day and night. This should include considerations for people with disability, mobility or width and weight requirements.
- Vector-borne diseases can be controlled through a variety of initiatives, including appropriate site selection and shelter provision, appropriate water supply, excreta disposal, solid waste management and drainage, the provision of health services (including community mobilization and health promotion), the use of chemical controls, family and individual protection and the effective protection of food stores. The numbers of disease vectors that pose a risk to people's health and nuisance vectors that pose a risk to people's well-being should be kept to an acceptable level.
- The disaster management system should prepare an environment that is uncontaminated by solid waste, including medical waste, and have the means to dispose of domestic waste conveniently and effectively.

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Chapter 16

FLEXIBLE SURGE CAPACITY

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Summary

This chapter discusses the term Surge Capacity and presents the concept of Flexible Surge Capacity, which is an approach to enable the emergency management system to improve responses to future major incidents and disasters by creating conversion plans for unconventional healthcare resources to assist the emergency management system.

Introduction

A major incident or disaster (MID) is an event with a range of severe consequences that necessitate an organized response by responsible authorities and often demand an immediate rearrangement of available resources (1). As the frequency and intensity of MIDs are predicted to increase in the future due to climate change and several other factors (2-3), the collective ability of the healthcare sector and other parts of society to efficiently respond is crucial for the outcome of these events. As efficient MID responses require robust public emergency management based on correct risk analysis (1), planning and organizational structures are crucial for operational efficiency and comprehensive resource coordination (4-5). There is a need for dynamic resource utilization during all types of MIDs. Such flexibility necessitates plans for proper use of available resources, a collective sense of social responsibility, targeted public education initiatives and extensive contingency planning based on correct risk assessment and analysis (1, 6). The concept of Flexible Surge Capacity (FSC) aims at strengthening resilience against future MIDs by securing sufficient resources available to the disaster management system through comprehensive contingency planning, community participation and public education.

Flexible Surge Capacity

The measurable ability to scale up operational healthcare capacity to respond to and cope with a sudden influx of patients is called surge capacity (SC) (4, 7). SC can further be understood as the resources within its four components [4S]: *Staff, Stuff, Structure* and *System*. All four components are essential elements of healthcare provision in general and in MID management in particular. For example, lack of staff is generally a restrictive factor for how many patients can be cared for in a disaster situation (4). Intuitively, any type of healthcare provision also requires medical materials and equipment along with an efficient organizational structure and leadership. SC plans must therefore secure sufficient and adequate access to resources within all 4S components in order to respond to static and dynamic events throughout a multitude of possible timelines. It is widely recognized that medical SC should be dynamic and flexible in real time (4, 6). As SC plans are integral to comprehensive contingency planning, they are also central to general disaster preparedness and Disaster Risk Reduction (DRR) as outlined in the globally agreed upon Sendai Framework (3). For these reasons, it has been suggested to develop a tiered, scalable and flexible SC system for mass provision of healthcare in MIDs, i.e., the concept of Flexible Surge Capacity (FSC) (1, 8-9). The FSC-response system would make available additional human and material resources by activating non-conventional medical staff and Alternate Care Facilities (ACF's; *used synonymous with Alternate Care Site as defined by the Center for Disease Control and Prevention (CDC)*) (10) to alleviate pressure on the conventional emergency healthcare apparatus.

Primary SC consists of three levels that constitute the capacity to maintain a standard of care: Conventional SC is the first level and can maintain the standard of care during a MID. The second level, Contingency SC,

requires adaptations to facilities, materials and staffing to maintain standard of care. The third level, Crisis SC, implies insufficient resources in one or several of the 4Ss, which may influence the ability to respond to the acute demand for care. Crisis SC is implemented during disasters and catastrophic situations, which significantly influence the standard of care (11-12). FSC resources can be activated to increase the contingency or Crisis SC by adding resources to the emergency response system, or be an additional tier of resources for the emergency response system, organized as Secondary level of SC.

In response to a MID or Mass Casualty Incident (MCI), the emergency management system can, apart from adding more resources, also free up resources by altering the standard of care. Resources can then be made available to treat more patients, potentially saving more lives. It is ethically essential; however, that there is a return to normal standards of care as soon as the situation allows (6). Providing care in a non-traditional healthcare environment will require facilities that can support implementation of recommended practices and an acceptable standard of care (10). It is therefore imperative that any deployed ACF maintain the standard of care at the highest possible level. This includes sufficient access to personal protective equipment (PPE), laboratory equipment, pharmaceuticals, security etc. (7, 12).

FSC Resources

FSC planning requires extensive and thorough efforts to identify and map resources in the community that can be useful in MID scenarios. Regional and local capacity evaluations in collaboration with the public health authorities can identify useful and untapped 4S resources within the community that can be incorporated into the emergency management system. In some contexts, non-governmental organizations, parts of civil society and the private sector may also contribute in resource mapping and vetting. FSC resources may be incorporated into the emergency management system from several different sectors in civil society as well as from a military setting (Civilian Military Collaboration, CIMIC) (14-15). The MID response system must combine response elements, match the resources to the needs of the situation and comprehensively coordinate the medical and public health response in a timely manner (6). Multinational coordination of disaster preparedness efforts could improve interoperability and mitigate the risk of repeating mistakes (16)

Using existing untapped resources can, if used wisely, ensure lifesaving and sustainable 4S accessibility throughout the phases of a MID. FSC deserves recognition and support from all agencies within the emergency management sector (1, 8). Below is a non-exhaustive list of sectors that may contain untapped resources that can prove useful in FSC planning:

- Primary healthcare centers and outpatient clinics can, alongside holding a proactive and informative role, also be able to handle ambulatory surgical cases or alleviate pressure on nearby hospitals' by accepting patient admission/intake for disaster related or non-disaster related emergency cases (1, 8).
- Veterinary clinics who have advanced medical knowledge can easily take part in predefined healthcare provision activities during a MID response. Veterinarian resources may assist the conventional healthcare sector by providing ventilators, additional physical capacity, pharmaceutical resources and staff capable of assisting in intensive care (1, 8, 17-18).
- Dental clinics have both medical staff and materials that can be utilized during a MID (1, 19).
- Nursing home beds can be converted for emergency care use, sometimes with an existing oxygen supply (20).
- Facilities ranging from parking garages, convention centers, sports arenas and hotels can and have been used as temporary clinics or as housing for displaced people in a variety of scenarios (13, 21).
- Military field hospitals can be deployed in Civilian Military Collaboration (CIMIC) for provision of civilian care (22).

Establishing an Alternate Care Facility (ACF)

Alternate Care Facilities (ACFs) can be deployed for several purposes and are a viable strategy to cope with many types of MIDs. An ACF can act as an alternate transport destination for MCI victims (24) or as a location for non-critical patients to be cared for, enabling the hospital emergency departments to concentrate on MID related patients (21). To provide care in a non-traditional environment, such as an ACF, is a recognized measure in disaster medicine and has for long been used in many settings and countries, even if the terminology has only recently been more or less established (20-21). An early example of an ACF can be found in the improvised clinics that were erected after an earthquake in Turkey in 1999 (25), but some of the best contemporary evidence in support of ACFs might be the successful incorporation of unconventional 4S resources in the respective responses of many countries to the global COVID-19 pandemic (13, 26-27). The use of ACFs in this regard ranged from hospital-level facilities with standards comparable to that of a traditional hospital (e.g. Philadelphia, Pennsylvania, USA) (13) to overflow facilities that increase general hospital bed-capacity (e.g. Javits Centre in New York, USA) (26), and critical care units (like the the Nightingale Hospital, housed in a conference center in East London, UK) (27).

There is no universal recipe for selecting a facility to convert into an ACF because it inevitably varies with the purpose of its deployment. The building selection process should also be preceded by a definition of the role of the planned ACF and considerations of any retrofitting necessary for optimal usability. Non-medical structures that can be adapted into ACFs are sometimes called 'facilities of opportunity' or "buildings of convenience" (20, 28). It is worth reiterating that all ACFs require facilities that can support implementation of recommended practices and an acceptable standard of care (21).

The Need for Public Education in FSC

An often-present prehospital shortcoming is either insufficient staff, resources and/or infrastructure, which can lead to a gap in time before medical professionals arrive. This therapeutic window can, if not used wisely, result in poor management of a MID (1, 29). Prehospital professionals and first responders are the essential link between victims and definitive medical care, but before they arrive at the scene of a MID, self-rescue and mutual rescue by citizens, volunteers, and other immediate responders can play a critical role to the outcome of a MID (1, 6, 29). If the public is to be incorporated into MID response, they must be trained how to do so. According to international recommendations, civilians should be empowered and promoted in self-dependency, first aid, and other simple procedures to respond to a MID quickly (1, 29). Immediate responders' initiatives such as Stop the Bleed in the U.S. and CitizenAID in the UK can broaden and deepen the public knowledge of first aid and strengthen the general preparedness and resilience within the community (29).

The Sendai Framework defines an attainable global path to address existing and potential future risks. The Sendai framework establishes the global objective as strengthening the capacity of people, communities, countries and systems to withstand and recover from shocks, persist through stress and transform through crises (3, 30). The United Nations Office for Disaster Risk Reduction (UNDRR) calls for collective, participative action as countries, communities, individuals and organizations all bear a role in reducing risk and building resilience (3). Because the ability to provide an adequate level of medical care is closely associated with national resilience (16) medical SC plans are of special importance in disaster preparedness. As community participation is central to disaster risk reduction, public education is an essential part of FSC. Using community participation as a method, the emergency management system can discover opportunities to expand the available SC resources while also strengthening societal resilience (31).

There is a need for scientific studies that can contribute data on disaster preparedness and pin-point areas for improvement. For instance, it would be helpful to construct scenario-based models that can help in quantifying medical resource requirements during a MID over time (30). Another area of interest is the

measurable benchmarking of countries' disaster preparedness within the hospitals, either when they receive casualties or when they need to evacuate (16, 33-34).

Conclusions

Medical SC planning is central to any successful MID response and is an essential component of the public health contingency system. The FSC concept is an attainable and realizable approach for an emergency management system to improve responses to future MIDs by creating conversion plans for unconventional healthcare resources to assist the emergency healthcare system. The implementation of the FSC concept requires extensive capacity and capability mapping to identify any untapped resources outside of the conventional emergency health care system that are possible to reallocate to a MID response. These resources can come from different private and public sectors: e.g., primary healthcare centers, dental and veterinary clinics all have medical capabilities, facilities and materials that can be utilizable in a MID. Schools and sports facilities can offer their structural resources to house an ACF or a vaccination center. Once identified, these local resources that offer utilizable elements can be included in FSC plans and drilled in their function.

The concept of FSC is applicable and generalizable to all countries and scenarios. However, new policies and other measures, such as public education initiatives, drills and exercises are necessary to fully implement the FSC concept. Targeted education initiatives can prepare the public for MIDs and improve the overall societal response to the event, but drills and exercises with all participating actors in the emergency management system must be performed to test the system for functionality. Furthermore, there is a need to evaluate the ethical consequences of the FSC concept in each context it is implemented. Standards of care must be concretized in and be on par with the appropriate legal and ethical framework.

Take-Home Messages

Multiagency preparedness requires innovative policymaking, establishing partnerships between state, regional and local actors, defining roles and boundaries as well as conducting drills and exercises. A FSC system approach can enable the emergency management system to improve responses to future MIDs.

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Chapter 17

FLOOD MANAGEMENT

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Summary

A phenomenon that has affected humankind since the earliest days of the civilisation, flooding is amongst the most dangerous and common disasters caused by nature in the world. It causes enormous economic loss and poses a serious threat to health and life (1-4). Unfortunately, the frequency and severity of floods are predicted to increase in the future due to climate change (5). Therefore, it is vital to take measures to prevent, counteract and mitigate their effects. An example of these actions in the European Union (EU) is the implementation of the 2007 Floods Directive, which created a common framework to manage flood risk (2). This chapter discusses the issue of floods and flood management with reference to selected legal EU regulations, presenting both technical and non-technical methods of flood protection.

Introduction

The most common disasters caused by nature, floods, killed at least eight million people in the 20th century alone (6). Between 1998 and 2017, they globally accounted for 43.4% of all nature-caused disasters, resulting in 11% of disaster-related deaths and affecting 45% of the victims of all hazardous occurrences (7). Excluding structural failures of hydraulic structures, a flood is a disaster primarily induced by hydrometeorological phenomena that cause high water levels in rivers, also known as high-water stages (8). As these are a natural element of river discharge, and in a broader perspective, part of the hydrologic cycle, they should not be deemed disasters at all. Floods are events that occur when natural hydrologic phenomena begin to impact human activity on flood plains, where they cause measurable economic, social and moral damage (9). The latter of these is the least tangible as it is connected with human psyche and emotions, including subjective harm in victims that stems from the flooding itself, flood-related destruction of their sense of security, and in the worse case scenarios loss of material goods, or even the death of loved ones. In consequence, floods influence numerous aspects of the socio-economic life and are considered an external threat to public safety. Globally, floods cause widespread damage, especially in densely populated areas exposed to heavy land use (10). As a result, enormous financial expenditure is invested in flood protection and the mitigation of flood-related effects. Decisions on the allocation of resources to ensure flood protection are made on the determination of the costs entailed and the expected benefits that such actions may bring. From the economic point of view, the outlays incurred for flood protection should be outweighed by the expected results. For this reason, accurate damage estimation is a crucial part of flood risk management (11). Flood-related damage stems from the conflict between nature and human land use, and, given the worldwide developments taking place, the scope and scale of damage is constantly changing, (12). Flood damage (everything that is lost or destroyed) refers to the effects floods have on people, animals, crops and plants, cultural heritage, municipal infrastructure, and industrial production (13). The damage can be divided into direct and indirect. The former results from a direct impact of floodwaters on people, property, and the environment, while the latter includes transport disturbances and loss related to limited production when infrastructure is damaged (14-16). Floods cause direct and indirect damage in not only directly affected regions, but also their effects extend to areas outside the immediate vicinity of the flood. What is more, the period of their impact may be considerably longer than the flood itself (17). The two types of damage are divided into material and non-material damage, depending on whether or not they can be assessed monetarily. Material damage is easily expressed in monetary units, whereas non-material damage is difficult to put a market value on (18). Although differentiation between direct and indirect, and material and non-material damage is common practice, the

interpretation and definitions vary (19). Thus, the general categories of flood-related damage may include:- Direct, material damage: damage to private property and technical infrastructure (e.g., public roads, railway lines, etc.), reduced business activity in the affected area:

- Direct, non-material damage: loss of life, loss of family heirloom, negative effects on ecosystems,
- Indirect, material damage: losses resulting from traffic disturbances, lost tax revenues due to flood-related migration of businesses, losses sustained by businesses from outside the flooded area,
- Indirect, non-material damage: loss of confidence in public authorities and bodies, and psychological and emotional traumas.

It is usually easier to assess the costs of direct than indirect damage. Assessment of flood-related damage is conducted on various spatial scales:

- o Microscale – losses are calculated for each building,
- o Mesoscale – loss assessment based on spatial aggregation is applied (units of land use with a surface area of between 1 ha and 1 km²),
- o Macroscale – loss assessment is based on administrative units, i.e., municipalities, regions, states (18).

The high incidence and negative effects of floods required that effective flood risk management be implemented (20). In response to the extreme floods in the 20th century in Europe, the EU issued the Floods Directive (21), the main purpose of which is to reduce flood risks and mitigate flood-related effects. The introduction of the Floods Directive (which applies to all types of flood) by EU member states is a three-stage process that entails an obligation to adopt and implement the directive and to develop preliminary flood risk assessments (Stage 1), flood risk maps and flood hazard maps (Stage 2), and flood risk management plans (Stage 3) (12, 22).

Flood hazard versus flood risk

Flood risk can be defined as hazard (physical aspects of flood), exposure (of people and developed land to flood), and vulnerability (of people and developed land to the hazard) and the ability to counteract the disaster and mitigate its effects. Co-occurrence of the three elements forms the so-called Risk Triangle (Fig. 1) (23). Total risk should be understood as the totality of fatalities, injuries, material damage and business disturbances related to and resulting from flooding, i.e., the probability of a flood and all its multidimensional consequences, whether of a desired and undesired nature (24).



Figure 1. Relationship between flood risk and flood hazard Source: Randolph (2004, p. 201).

Pursuant to current EU laws and regulations, flood risk should be perceived as a combination of the probability of a flood and its negative effects on people’s health, the environment, cultural heritage and

businesses (25). The level of flood risk is conditioned by a number of factors that may be classified as vertices of the risk triangle. Firstly, there is a hazard, identified by the level of high water and determined by the possible scope of flooding. In order to minimise the flood hazard, levees and artificial reservoirs are built. However, it must be stressed that steps taken to reduce flood hazard should mainly focus on increasing the retentiveness of catchment areas (26). The second group of factors (classified as exposure) are both natural elements and anthropogenic elements (e.g., socio-ecological and legal) of the environment within the area at risk of flooding during a flood. These could be facilities, infrastructure and communities located in areas at risk of being flooded. Reduction of exposure primarily entails an efficient policy of spatial management that provides effective local laws to limit land use, especially in valley floors, e.g., construction restrictions or even bans (27-28). Finally, there is vulnerability, an umbrella term describing factors that determine to what extent people are prepared for, and ready to react, in the event of a flood, including their ability to restore the state of equilibrium that characterised life before a flood occurred. In this context, vulnerability is defined as general preparedness of infrastructure, facilities and people in areas at risk of flooding. Methods used to lower vulnerability involve protecting buildings, applying early warning systems, making plans for evacuation and flood risk management, including family flood plans, etc.

At an international level, EU member states (following the 2007 Floods Directive) prepare flood hazard maps (hazard factors) and flood risk maps (vulnerability factors). The former define areas of a specified probability of a flood (its possible scope), floodwater depth, and speeds and directions of flows for various flooding scenarios, whereas flood risk maps show any potentially negative effects of floods that would occur for individual scenarios presented on the flood hazard maps. With regard to the aforementioned perception of risk, maps allow each citizen to verify whether they live within the areas at risk of flooding, and, if so, what the flood probability in their area is (29). Additionally, the information on the maps also facilitates more effective responses and emergency management in the event of a flood. Nevertheless, the main reason behind such maps is constructing flood risk management plans, i.e., the technical, financial, and political guidelines for early flood risk management for the prevention of, protection against, and preparation for a possible flood (30).

Flood management strategy – managing hazard and risk

In recent years, there has been a radical change in the approach to the issue of flood protection (as seen in the approach formulated within the 2007 Floods Directive). Nowadays, it is no longer believed that there is such a thing as complete protection against flood, but that the damage and loss it inflicts can only be mitigated, and since floods cannot be completely eradicated, societies must learn how to live with them. Unfortunately, empirical data from the second half of the 20th century indicates a growth in flood-induced losses related to natural (a rise in the frequency of heavy rainfall) and anthropogenic factors (9). Among the latter, the most important was an increase in land use within the areas at risk of flooding, which is the result of the illusion of safety provided by modern methods of flood protection (levees, artificial reservoirs, etc.).

In the light of these facts, risk management plans, whose development and upgrading in 6-year cycles is imposed by the Floods Directive, should instigate a relatively holistic management of flood hazard and flood risk that incorporates a range of technical and non-technical measures. Mitigation of flood-related losses should take into account a comprehensive spectrum of actions, from prevention and education, through measures taken during a flood, to strategies that help people return to normalcy once the disaster is over. These tasks can be provisionally divided into three thematic areas:

- keeping the flood far away from people,
- keeping people far away from the flood,
- learning how to live with floods.

The first thematic area includes conventional technical measures of flood protection: artificial reservoirs, detention basins, levees, floodgates, flood control channels, dry dams and reservoirs, etc. However, it must be stressed that, nowadays, such solutions are recommended exclusively for locations where flood-related losses

cannot be easily mitigated in any other way (for instance, in floodplains where there is dense construction, e.g., in cities). Today, more attention is being paid to mitigating flood-related losses by increasing the retention capacities of riverine catchment areas. This can be achieved by re-naturalisation of watercourses, protection of existing wetland and reconstruction of degraded ones, and forestation of watersheds and steep slopes. In urban areas, it is advisable to make existing surfaces permeable and ensure the construction of new ones follows this trend, as well as managing rainwater efficiently by creating 'green roofs', and using it to water home gardens and flush toilets. At the same time, the rainwater that does drain into the runoff system should be stored in underground reservoirs and released to a nearby river only once the possibility of flood has receded.

The second thematic area contains measures to restrict land use in places at risk of flooding. There is a broad spectrum of non-technical solutions related to spatial planning and construction law. These solutions aim to prevent (now or in the future) building development in areas for which there is flooding hazard. Other measures therein include technical solutions to minimise flood-related losses by protecting buildings and their immediate surroundings (erecting walls, making buildings more water resistant, moving vulnerable components of the central heating system upstairs, etc.).

The third thematic area involves the application of a whole repertoire of non-technical measures. The first is educating residents on floods, ways of mitigating loss and damage, and appropriate reactions to an actual disaster. Another solution is creating systems of hydrometeorological protection that allow for early warning signals to be sent so that local residents have time to prepare for an extreme occurrence. These systems may be for different resolutions and scales. For instance, there is a global tool for satellite mapping of flood conditions (in practice: 50°N – 50°S), called the Global Flood Monitoring System (GFMS). Based on precipitation data from NASA satellites, information from the satellites of the Global Precipitation Measurement Programme, the digital terrain model, and maps of land cover, soil, and relief, GFMS generates a 5-day flood forecast (31) that contains volumes of precipitation and riverine flows, and water levels in flooded areas. The applied resolution is 1 km with a time step of 3 hours, and the model is available online (32).

On a national scale, hydrological forecasts are issued. These have substantially higher resolution and are prepared by institutions responsible for monitoring hydrometeorological phenomena through weather surveillance radars and a rich network of precipitation stations. These meteorological forecasts and warnings are most commonly posted on institutions' websites. A national example is a project called ISOK (Informatyczny System Osłony Kraju) – a computerized system for the protection of the state that contains all information on possible dangers facing Poland. As floods are most severe and common naturally caused disasters in the country, and ever since the disastrous 2010 flood, the tool has been mainly dedicated to flood-related threats. The tool, offered free of charge to public administration (bodies responsible for spatial planning, flood protection, and emergency management) and all citizens (33-34), is an example of how flood risk management can be successfully improved on a local/regional scale.

Another important solution is the early warning systems based on text messaging (Short Message Service). Today, the digital era allows users to install mobile applications that update them on different hazards, including flood risk. The EU implemented the EU-Alert System based on Cell Broadcast (CB) technology. The CB system sends messages to mobile phones using the network of base transceiver stations and GSM transmitters. This solution is vital when it comes to warning people in the event of a disaster and alerting them to possible hazards, including floods (35). Importantly, the EU obligates its member states to implement a public warning system that uses telecommunications networks by June 21, 2022.

In the event of a flood, pre-prepared procedures to counteract and mitigate the effects of the disaster are followed, including evacuation of people and movable property from affected areas. What may prove extremely useful during an actual flood are tools for satellite mapping of flooded areas, e.g., the Moderate Resolution Imaging Spectroradiometer (MODIS), which incorporates two sensors mounted on two satellites (Terra and Aqua). The sensors capture data in various spectral bands at spatial resolutions of 250 m, 500 m,

and 1 km. Owing to its high time resolution, the tool makes it possible to track landscape changes in time (including the size of floodwater flow). Finally, during the post-flood restoration stage, victims should have access to programmes of psychological and financial assistance, and plans should be implemented to restore living conditions and the full efficiency of infrastructure.

Conclusions

There are two schools of thought regarding the process of disaster management. The first says that strategies and planning cannot be entirely successful, whereas the second proposes that better strategies and planning can improve disaster management (36). The paradox assumes that it is impossible to prepare accurate prognoses or effective responses (37). Any efforts to improve disaster management are primarily restricted to improving prognoses and reactions – which customarily take the form of more efficient communication (36). Despite the fact that the management of disasters (something unpredictable) is only possible to a very limited extent, planning still remains its fundament. It is vital that strategies be implemented, even though no disaster caused by nature is identical and despite the fact that they always differ from what was predicted (4). Flood protection must be perceived as a comprehensive procedure that incorporates technical and non-technical protective measures. In order to mitigate the scope and effects of a flood, one must integrate all tasks covering the management of flood hazard and flood risk. In the case of flood protection, the most important thing is the initiative of people residing in areas at risk. The actions taken by residents on floodplains are a significant constituent of national strategies and plans of flood risk management in many countries.

Take-Home Messages

Anyone who lives in the vicinity of a river should be aware of the hazard and keep the following in mind;

- The level they should begin to evacuate,
- What flood warning systems are used in the area,
- At what stage they should self-evacuate, and what places of safety are prepared for their area.

In order to mitigate flood-related damage, residents of areas at risk of flooding should:

- Insure their homes and belongings,
- Take appropriate measures (installing a capable and effective rainwater drainage system around the house, preventing possible sewer backup, etc.),
- Protect their property (installing solid enclosures made of concrete or soil, making the house more water resistant and better prepared for flooding),
- Prepare the whole family for a flood and evacuation. The most important measures are family flood plans. These plans should include a map with evacuation routes and potential safe destinations, emergency phone numbers, directions for how to identify safety areas, main switches for power, gas, and water installations, and a pre-established safe place for important documentation and valuables. All home owners should be made fully acquainted with this plan (38).

People's knowledge and awareness of possible dangers, combined with a readiness to react appropriately to a natural hazard increase the effectiveness of evacuation and help mitigate flood-related losses.

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Chapter 18

FOOD SAFETY AND SECURITY

Milad Ahmadi Marzaleh, Mahmoudreza Peyravi, Amir Khorram-Manesh

Summary

During and following disasters, affected populations are at risk for outbreaks of foodborne diseases, mainly related to unsafe food storage, handling, and preparation, making food safety one of the top public health priorities. Disaster-affected populations often experience food shortages, denial of access to food or inability to safely use it. Those determinants may result in the quick emergence of food insecurity; food security here defined as uninterrupted access to sufficient, safe, nutritious food to maintain a healthy and active life. The aim of this chapter is to describe public health hazards related to food safety and food insecurity during disasters.

Introduction

Disasters and food insecurity are directly interconnected. Floods, hurricanes, tornadoes, tsunamis and other hazards may ruin food, destroy agricultural, livestock and fishing and food processing infrastructure, resources, inputs and manufacturing capability. Hazards disrupt market accessibility, trade, and food supply, minimize earnings, diminish savings, and erode livelihoods. Drought, plant pests and diseases, such as locusts and armyworms, animal diseases like African swine fever, and food contamination or adulteration, have a direct financial influence by decreasing or eliminating farm manufacturing, by negatively influencing costs, industry, and market accessibility and by decreasing farm earnings and employment. Economic crises, such as soaring food prices, reduce real income, force the poor to sell their assets, decrease food consumption, and reduce their dietary diversity and access to safe and quality food. Disasters create poverty traps that increase the prevalence of food insecurity and malnutrition (1-3).

In the aftermath of disasters, food may become contaminated very fast, exposing the public to potential health hazards. Preventive food safety measures should be implemented to ensure that safe food is delivered to the affected population, including preventive water treatments and measures to reduce food-borne diseases (e.g., cooking, disinfection). There is also a need for practice guidelines to inspect and salvage food, including rules for inspection, proper labeling, and stocking of salvaged food, protocols for the disposal of food unfit for human consumption (including food contaminated by radiation/chemical agents) and respect of the cold chain. Food security means simply that food must be available in sufficient quantities and on a consistent basis. It considers stock and production in a given area and the capacity to bring in food from elsewhere, through trade or aid. It also means that people must have regular access to adequate quantities of food, through purchase, home production, barter, gifts, borrowing or food aid. Finally, consumed food must have a positive nutritional impact on people. It entails cooking, storage and hygiene practices, individual health, water, and sanitation, feeding and sharing practices within the household (4-6).

There are two kinds of food insecurity: chronic and transitory. Chronic food insecurity is a continuously inadequate diet caused by a household's persistent lack of ability to buy or to produce enough food. Transitory food insecurity is a temporary decline in a household's access to enough food. It often results from instability in food prices, declining food production or household incomes—and in its worst form produces famine. Food availability itself may not be the only factor affecting safe food provision. However, the most relevant determinants for the provision of safe food after a disaster may include education on how to consume food that the affected population is not familiar with, provision of safe water, tools and fuel for cooking, and alternatives to mass feeding when feasible. Unsafe food may cause food-borne diseases resulting in serious public health hazards, such as diarrhea, intoxication, etc. Implementation of strategies and measures to

identify and response to outbreaks of food-borne diseases is necessary. In order to implement effective strategies, the actual level of food security and nutrition in the affected population needs to be continuously assessed by using a framework for food security assessment considering food availability, food access and food utilization as core determinants of food security, linked to households' asset endowments and livelihood strategies (7-15).

The objectives of food security assessment include:

1. Identification of prevalence, geographical distribution, and severity of food insecurity and malnutrition in the affected population.
2. Identification of main determinants of food insecurity and malnutrition in the area.
3. Strategies to cope with the situation developed by the affected population.
4. Forecast scenarios for up to 12 months.
5. Establishing the need for an intervention (including the provision of external food supplies), and
6. Evaluation of interventions performed.

Deciding data, indicators, and source of information for the developed program is of utter importance. These data should be carefully chosen and linked to the program objectives in order to be able to define intervention thresholds, prioritize and cross-tabulate them. For an effective planning and implementation of food security assessments, there is a need for human resources, administration and logistics, primary data collection strategies, methods of analysis of the collected data and reporting the assessments results. With an increasing size of human population, the world is facing new challenges in global food safety and security, i.e., food that is safe and nutritious (16). The increasing number of public health emergencies and disasters necessitate the recognition of the eminent threat to food safety and security for upcoming generation and the need for a holistic and systematic approach that may encompass educational initiatives in a multiagency curriculum with skills in information sharing, collaboration and teamwork, communication, etc. (17). Furthermore, new strategies should be implemented locally, regionally and on the national level to intensify disaster risk management for food security (18) and to improve emergency food reserve policy to guarantee food security and safety management during disasters and emergencies (19).

Conclusions

During and following disasters, affected populations are at risk for outbreaks of foodborne diseases, mainly related to unsafe food storage, handling, and preparation, making food safety one of the top public health priorities. Disaster-affected populations often experience food shortages, denial of access to food or inability to use it safely. The long-term impacts of disasters may result in severe health issues, malnutrition, physical, mental and emotional disorders. Securing the availability of food and nutrition are an important part of the tasks of all involved governmental, non-governmental and charity organizations, which prepare and distribute food during and after a disaster (8-15). Therefore, the safety of food should be guaranteed by continuous control and monitoring of processes and systems.

Take-Home Messages

- Food safety and security are vital for the survival of disaster victims. Recognize a food and nutrition emergency.
- Strengthen disaster preparedness and the ability to mitigate the impact of emergencies that affect food security and the productive capacities of rural populations.
- Appropriate logistics and supply chain resilience in disasters reduce food-related complications.

- Continuous monitoring of the available food should be mandatory in all disasters. Monitor the adequacy of the food aid and emergency nutrition response and conduct nutrition surveillance.
- Understand key emergency nutrition interventions.
- Target needy population groups and equitably distribute an adequate quality and quantity of food aid. Perform rapid assessments of the impact of disasters on employment and income.

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Chapter 19

DROUGHT AND FAMINE

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Summary

Drought is one of the major natural threats to people's livelihoods and socio-economic development. Although drought tends to occur less frequently than other hazards, it can result in a larger proportion of the population being affected than by other disasters. Drought may have wide-ranging social, environmental, and economic impacts. Furthermore, drought is frequently an important contributing factor for famines in which entire communities may literally starve to death. With an increasing impact of climate changes, the disaster management systems, globally, need to take appropriate strategies to prevent and/or mitigate the impacts of drought disasters and should be prepared to manage these disasters in case of occurrence. Education and training are essential for all disaster management staff, including managers and responders in order to reduce the risk. This chapter aims to present an overview of drought and famines in a global perspective.

Introduction

Drought

Although drought may be erroneously considered a rare and random event, it is a natural part of the climate. It occurs in virtually all climatic zones, but its characteristics vary significantly from one region to another. Drought is a temporary aberration; it differs from aridity, which is confined to low rainfall regions. A broad definition of drought is a deficiency of precipitation over an extended period, usually a season or more, which results in a water shortage for some activity, group, or environmental sector. However, in terms of typology, droughts are classified as meteorological, hydrological, agricultural and socio-economic. Of the four drought types, the first two describe the physical event, whereas the third describes the particular impact of the first two on agricultural production. Meteorological drought describes a situation where there is a reduction in rainfall for a specified period (day, month, season, or year) below a specified amount. Hydrological drought involves a reduction in water resources (stream flows, lake levels, groundwater, and underground aquifers) below a specified level for a given period. Agricultural drought is the impact of meteorological and/or hydrological droughts on crop yields (1-4).

Socioeconomic drought differs markedly from other drought types because it reflects the relationship between the supply and demand for some commodity or economic good (such as water, livestock forage, or hydroelectric power) that depends on precipitation. Supply varies annually as a function of precipitation or water availability. Demand also fluctuates and is often associated with a positive trend because of increasing population, development, and other factors. Of all natural hazards, droughts are potentially those having the greatest economic impact and affecting the greatest number of people. Of the main hazards, droughts are unique in terms of the "warning time": the length of time between the first indications that a drought is developing and the point at which it begins to influence the population of the affected area (5-6). The varying and potential economic and social impacts of agricultural droughts can be:

- Reduced income for farmers and agricultural workers,
- Inability of certain groups within the population to afford increased food prices,
- Reduced food intake deteriorates nutritional status and reduces ability to resist infection,
- Difficult and scarce availability of water results in a general increase in diarrheas and other water/hygiene-related illnesses,

- Increased competition for access to remaining water sources may lead to increased incidence of local disputes/conflict, etc.

The main health impacts of drought can be divided into the following groups (5-6):

- Malnutrition
- Anti-nutrient consumption
- Water-borne diseases
- Air-borne and dust-borne diseases
- Vector-borne diseases (such as malaria, Japanese encephalitis, and West Nile virus), and
- Exacerbation of non-communicable diseases, migration, infrastructure damage and mental illness.

Several actions can be undertaken to reduce the impact of drought. The most important ones are the following (1-5):

- Improving water resource management
- Gearing up all government sectors to meet the new condition and needs
- Adopting strategic policies, forecasting, and issuing warnings, cultivating drought tolerant plants, using cloud seeding technology, planning to use modern irrigation methods, developing agricultural insurance, preparing a water supply plan, and
- Identifying coping capacities with drought damage, holding necessary meetings with experts and exploitation.

The UN 10-step framework and measures to deal with droughts are (5-11):

1. Forming a multi-sectoral working group
2. Formation and explanation of drought goals and issues
3. Finding sustainable participation methods
4. List resources and identify affected groups
5. Development of organizational structure and readiness plan
6. Establish communication between research and science production centers and policy makers and planners
7. Publication of the proposal, public incitement and encouragement
8. Execution of the plan
9. Development and expansion of training programs
10. Post-implementation evaluation

Famine

Famine is a phenomenon in which a large percentage of the population of a region or country are so undernourished that death by starvation becomes increasingly common. In spite of the much greater technological and economic resources of the modern world, famine still strikes many parts of the world, mostly in the developing nations. Famine is associated with naturally occurring crop failure and pestilence and artificially with war and genocide. Famine results from a sequence of processes and events that reduces food availability or food entitlements and causes widespread and substantially increased morbidity and mortality. Drought is one of contributing factors of famine. Famine is closely related to food security. Food security embraces three main objectives: adequate supply; stable supply; and access to supply. Food insecurity, in turn, is the lack of access to enough food (12-13).

There are two kinds of food insecurity: chronic and transitory, which are introduced in detail in chapter 18. Chronic food insecurity is a continuously inadequate diet caused by a household's persistent lack of ability to buy or to produce enough food. Transitory food insecurity is a temporary decline in a household's access to enough food, often due to instability in food prices, declining food production or household incomes, which in its worst form produces famine. Until recently, it was generally believed that the only cause of famine was a decline in food availability due to a reduction in production resulting from adverse weather, disease/pest infestation, or through a cutting-off of traditional sources of supply. However, over the last century there has been a growing understanding that famines can occur in areas where overall food availability has not declined, but as a result of a reduction in the ability of certain groups within the population to acquire the food.

For instance, it can happen because of a loss in their income or a sudden rise in the price of food. A range of natural and human-induced factors may cause declines in food availability. Some of natural factors are climate change, agricultural drought, floods, high winds, cold spells/frosts, crop disease, and pest infestation. Among the human-induced factors, there are conflicts, external economic shocks, internal macroeconomic mismanagement, forced procurement of farm produce by state organizations, and over-export of foods, which reduces the amount available nationally to below required levels.

Each famine is likely to have a particular combination of causal factors acting and possibly interacting in the process by which the famine develops (12-19). Throughout history, conflict has frequently been an important contributory cause of famine. The conflict has the effect of both reducing food availability and reducing the ability of people to acquire it. Because famines develop over a period of months and, sometimes, years, it is possible to detect their process and give a warning (famine early warning system), so that interventions can be made to limit their progress and avoid the destruction of livelihoods and increased mortality (14-15).

Many different programs, which help to maintain food security, have proven successful. These include the distribution of food to general or targeted populations, income producing programs, price control programs to help households purchase food, complimentary water, health programs to minimize morbidity and mortality and special programs to maintain livestock and other household assets. Famines are, in theory, preventable but they require significant organizational resources. The effective government response is critical to successful relief programs in response to famine. The system by which the international community and national governments respond to developing famines is extremely complex and not well formalized (10, 16).

Conclusions

An increasing number of drought and famine caused by nature or manmade together with an increasing vulnerability of the current management system necessitate a change in future organization and planning for future prevention and response (17-19). One important area is the assessment of situation and identifying affected areas to explore the capacities and facilities that can be used to reduce the outcomes of drought and famine (18). Providing storage facilities is one of the important measures that need to be planned and implemented before drought and famine.

Nevertheless, there are other factors, such as socioeconomic and educational factors, that also need to be considered in the future assessment before drought and famine occurrence. People play a vital role in modern drought prevention and management programs since they are the ones who can reduce the consequences of the drought by their choice and behavior. The basis of any drought and famine management program is the involvement of the people (13-16). No disaster management program in general and drought and famines program in particular can be successful without peoples' engagement.

Take-Home Messages

- Understanding the fundamental characteristics of the drought hazard and its risk, impacts, especially famine, and having a comprehensive overview of the current situation are necessary elements for a sustainable environmental development as a logical solution to combat drought and famine.
- The effects of drought and famine on health and health sectors are significant and necessitate a solid plan linked to climate change to promote effective measures that reduce negative health impacts.
- Understanding the principles of risk and disaster management, with respect to drought, in different levels (strategic, tactical, and operational) of action are necessary for management of drought and famine disaster scenarios and possible impacts, efficiently. Local educational initiatives to guarantee peoples' engagement are necessary for implementation of all recommended measures.

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Chapter 20

MEDICAL ASPECTS OF DISASTERS

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Summary

Medical issues should be considered during multidisciplinary management of a disaster. This is particularly important in the prehospital part of the medical management, due to the initial lack of resources and proper information. Logistics and preparedness capacity of the hospitals are also important factors influencing the medical outcome of victims and deserve special consideration. The aim of this chapter is to present the activities in the chain of health providers from the scene to the intensive care units, and their interconnections with other services during the disaster management, and to provide the list of skills and verified knowledge, which makes the providers competent to act during the disaster. Finally, it discusses the issue of leadership and the critical resources that need to be known and considered in the design and implementation of the prehospital and intra hospital plans.

Introduction

Medical response to a major incident (MI) is one of the critical parts of the multidisciplinary management of an incident or disaster, and its importance is highlighted by the high demands on the healthcare system during an incident. The goal of the health care system during an MI is to mitigate the loss of lives and minimize the physical and psychological consequences of the incident to the greatest extent possible. There is a chain of actions that must be coordinated, synchronized and harmonized in order to get the desired outcome. No element in this process is considered the weakest link as each link is as important as the others (1-2).

The main issue during the management of any event is the imbalance between the needed and the existing resources, which necessitates the optimal use of available resources, as well as relocation of other resources. The outcome of the medical intervention might be displayed in quantitative and qualitative parameters, which refers to immediate post-disaster and late mortality and morbidity, including the impairment of the quality of life. For a successful response to an MI, there need to be structured and disciplined plans. Previous experiences may be used for creating such plans and may be used as points of comparison by considering the outcomes of the medical interventions carried out during those various events.

By using risk and vulnerability analysis and lessons learned from the past events, we may not be able to prevent an incident but it may serve as strategies to mitigate and minimize its impact. In identifying risks, plans can be written wherein every risk and problem are managed by specified and appropriate steps, which were thoroughly discussed by the members of the disaster response team. Individuals will have their own clearly defined task. All these individual tasks together make up the organizational plan. These plans should further be tested and practiced in the form of drills to not only confirm their validity and staff's competency but also to indicate the gaps in planning and point out the weakest points. This ensures the appropriateness of the organizational plans to the specific needs of the particular institution. Other stakeholders besides healthcare institutions, such as government and national agencies for disaster management, regional command centers, etc., should also be part of preparedness, planning, and training activities. Many of these agencies are involved in the disaster response directly or indirectly (2-3).

Initial Assessment

The immediate first step after a disaster is to have an initial assessment of the damages and their consequences, future risks, and the outbreak of new conditions. For medical professionals, the choice of treatment for and outcome of any medical condition is directly related to the mechanisms of injury (4-7):

- **Physical trauma:** Military combat injuries, traumatic injuries caused by disasters.
- **Environmental injuries:** Electrical, chemical, and thermal burns, cold injuries, radioactive injuries, toxic gas inhalations and exposures, bioterrorism injuries.
- **Transport injuries.**
- **Hazardous materials explosions injuries.**

All details must be identified before a complete intervention plan can be established. It is also important to remember that under certain circumstances, the cause of an MI may be progressively persistent; hence, it can also potentially affect the members of the medical teams. Therefore, these teams must always wear their appropriate Personal Protective Equipment (PPE) and be able to apply the rules of self-protection; strictly or otherwise, they will end up as victims themselves. Most major incidents produce direct immediate victims, who are suffering the direct consequence of the event, as well as, secondary human damages, either because of complications from the immediate post-disaster circumstances or by developing later threatening conditions. For example, following an earthquake, the assessment should refer to the following (6):

- The number of persons, who suffered injuries needing immediate surgery,
- The number of victims who do not need immediate surgery but can develop complications of blunt trauma, such as renal failure (if the assessing team is not aware of the evolution of such trauma, it will focus only on obvious situations, such as open fractures, and will neglect people apparently with minor injuries, who can develop potentially lethal conditions), and
- The number of persons not directly affected by the earthquake, whose medical conditions may become complicated due to unsanitary conditions from compromised water supplies and lack of hygiene.

Based on the first assessment, the following points should be addressed for each victim (8):

1. The type of transportation from the scene.
2. The estimated travel time, which will not compromise the victim's life.
3. The place the victim must be transported to obtain adequate care according to the resources and specificities of the different structures. Although in some systems there is a distribution key that allows the transport of victims to available hospitals, the medical condition of patient and special needs for particular specialty should be in focus to send right patients to the right facility in collaboration with the regional command center.

The first on-scene report is crucial, but its quality depends on the qualifications of the people preparing it and needs to be completed with thorough evaluations by the specialized teams. Depending on the number of staff in the first team, it will not only provide information but also start building the first incident command post on the scene and if possible also initiate medical interventions with the available resources in the field (9). It is, therefore, important that the first team staff members are able to:

- Apply basic triage criteria, prioritize and conduct primary emergency management/treatment.
- Efficiently apply simplified diagnostic/therapeutic methods, with minimal supplies.
- Maximize efficiency using or relocating existing resources.
- Collaborate with other involved organizations and integrate the medical activities with the overall response.

Need for coordination

Once the damages to human lives are assessed, the information is processed by the coordinating structures. The coordinating structures must coordinate the transport of victims to hospitals taking into account the

conditions of the victims, the possibility or incompatibility of prolonged transport and the need for evaluation and treatment in specific facilities (e.g., patient with suspected intracranial hemorrhage to be managed in a neurosurgical facility). The characteristic of the area where the event occurs is as fundamental as the distance, the number and characteristics of the hospitals capable of handling the injured as well as the transport capacity. For this reason, major incidents in rural areas or during wartime, may require a different strategical approach as compared to what may be appropriate for those that occur in urban setting, and peacetime. The coordinating agency can ensure the transportation of the first victims to the appropriate hospitals (the closest where patients can obtain at least the minimum medical assistance necessary for survival) and the delivery of priority medical supplies and equipment to the disaster site. These supplies form the basis for the creation of a functioning field hospital capable of treating victims whose lives could be compromised by transport, or when relocation to other hospitals is not possible, or is not feasible due to the number of patients who need a transfer. The local presence of a field hospital is particularly important when transport is not available or when an MI is in progress, such as in war cases. In an urban context, the presence of a field hospital may be less useful while the greater presence of hospitals and the resources contained therein must be enhanced (1, 5, 7-8).

Resource planning

In order to conduct action efficiently, resource planning must follow the initial assessment, and should include:

- Identifying existing resources, often extremely limited on-scene but more available through a strong reorganization process at the hospital level.
- Establishing needs: Personnel, medical equipment, transport facilities, as well as potential sources of supplementing existing limited resources.

It is crucial to have the correct information about specialty services that are needed in the disaster zone so that members of the Emergency Medical Teams that are to be deployed are composed of trained disaster medical responders who can cope with the different demands that exist in the disaster area. At the same time, the distribution of patients in the different hospitals should be based on the continuous capacity evaluation of the resources, which is only possible with an efficient and rigorous communication between those at the scene (ground zero), the coordinating staff and the hospitals (8).

Implementing medical measures

Medical measures are to be implemented in the next step, which is performed at different levels. Regardless of the level, it must be emphasized that flexibility is essential as the effect of any medical intervention depends on the pre-disaster status of the injured people, which is difficult to estimate at the start of the intervention, as well as on the multiple pathophysiological changes induced by any type of trauma. Unlike a building, for which the degree of damage is relatively clear, it is almost impossible to determine the precise outcome of the patient, as human biology is complicated and variable, and taking into consideration human psychological factors, make it even more difficult, if not impossible, to predict the outcome immediately. For these reasons, it is mandatory that the medical teams should apply, whenever possible, the principle of Damage Control, which consists of applying the necessary actions in order to ensure patients' survival but without overwhelming the response capacity, already affected by the initial MI (10-11). During the entire period of medical intervention, a very important element is the regulation mechanism, which includes:

- An efficient system of field analysis and information communication to and from the central coordinating structures/agencies.
- Coordinating multi-organizational structure able to integrate the information and to adapt the intervention to the on-going situation.

- A communication system is essential to modulate the destination of patients in the various hospitals, trying to avoid overloading of some structures by underusing others
- A feedback system from the facilities already treating patients to detect potential complications and supplementary data to help the team in the field. For example, a late complication which could not be predicted but which is displayed by most of the patients should be immediately communicated to the field teams, so that appropriate measures to be taken from the beginning to avoid complications (1, 7, 10-11).

Besides, the necessity of training, which is unanimously recognized at present, another important issue is analyzing the results of medical interventions during disasters, which are valuable resources for designing ongoing activities and future action plans. Diagnostic and treatment protocols are not yet unified internationally, but attempts to establish scores are useful resources for establishing a relevant association. An example is the initial severity of the injuries in relation to the outcome of the patients, as well as to the efficacy of the treatment. This results not only in better communication between teams with different training backgrounds and protocols, but also increases the efficacy of the coordinated medical interventions, improves triage and the chances of the patients to get adequate treatment, and enhances the efficiency of using resources of involved organizations (10-11). When this type of analysis is performed it is important that it reflects the efficacy of medical intervention referring to:

- Direct visible effects of MI.
- Indirect effects, which do not result directly from the traumatizing factor, but may complicate the initial injuries.
- Secondary effects due either to over-triaging or by special conditions affecting the victims before MI.

To describe the competencies necessary for medical interventions, they can be evaluated on pre-hospital and hospital levels, which, although somehow different, have the same aim of decreasing mortality and morbidity and increasing the speed and quality of rehabilitation of the victims resulting from an emergency.

Prehospital engagement

The prehospital response starts on the scene, where victims should be triaged and treated using basic and necessary means and by medical staff on the scene under the supervision of triage officers. Later, victims should be transported to collecting areas for further transportation to the hospital or more detailed treatment, when this might be necessary. This is especially true in terrorist attacks, where primary damage control of the injuries can be vital for the best medical outcome. Transport to the hospitals or other medical facilities is supervised by an ambulance loading officer, who together with the dispatch center shall define the means of transportation, e.g., BLS (Basic Life Support) ambulance vs ALS (Advanced Life Support) ambulance, helicopter vs fixed-wing aircraft, etc. The entire on-site health management is under the supervision and responsibility of the medical incident commander (8-11).

Besides healthcare staff, other organizations have their staff on the scene as well. Two major players on the scene are the police and firefighters who both have their own tasks to do. Firefighters often operate within the hot zone, i.e. where the incident has taken place, while the police is responsible for the outer and inner cordon around an incident. Firefighters will be working together with healthcare staff after they declare the scene safe enough for the healthcare staff to approach. The police force will be responsible for controlling the in- and out-movement of individuals, registration of deaths, control of items, crime scene analysis, etc. The role of law enforcement is crucial in situations potentially linked to terrorist activities but require the collaboration and expertise of all agencies involved in the management of the major incident (1-2)

It must be clear by now that such multidisciplinary work needs to have a structure and leadership that can coordinate all activities between different stakeholders, establish administrative strategies and effective modes of communication on the scene. Although various countries may have different forms of disaster response, they all need to have an Incident Command System (ICS) consisting of commanders involving various stakeholders including a Medical Incident Commander (MIC), Police Incident Commander (PIC) and Rescue Incident Commander (RIC). These on-scene commanders are in turn connected to a higher command group, the Regional Command Center (RCC). This is especially important since the start and end of the management process should be declared by a higher level, and the follow-up during recovery phase must be organized and structured in all levels.

Hospital engagement

Each hospital (irrespective of dimension, competence and resources) must have a disaster plan, by which different functions of critical importance during hospital response will be initiated. The MI plans have to be clear, simple to apply, understood by all of medical, as well as non-medical staff members of the hospital and tested through regular simulations and drills (12). The hospitals should be notified as soon as possible and start alerting their disaster response team. Those who are physically present in the hospital should start their preparation phase depending on the reported scale of the incident, and different preparedness levels will be declared. A progressive level of activation (e.g., Green, Yellow, and RED) guarantees an adequate response time to different MI-related operational level, depending on the distance between scene and the closest medical facility, the number of injured and other health facilities involved (2-3).

A disaster plan must have a so-called “All-Hazard concept,” which simply means that the structure of the plan must be adjusted for the management of most of the events, irrespective of the causes. Alert process and levels of alert initiate different functions in various parts of the hospital. All staff should have action cards in which each staff member is given specific tasks to accomplish. Altogether, they will then accomplish a larger task. A hospital will go through different phases: *alert* phase and subsequently *receiving*, *treatment* and *recovery* phases. It is important to note that in a specific period and at the same hospital, different units may be working on different phases of management. While the emergency department has already finished the first steps and is in a recovery phase, the operating room/theater and intensive care units may be busy dealing with treatment phase. All these phases also demand an effective plan and structure (2-3, 8, 11, 13).

Right from the onset of any disaster or MI, all hospitals need to initiate a *coordination and command center*, which should be in direct communication and coordination with the regional and national level agencies to ensure their support and help as necessary. The Hospital Command and Coordination Center has the mandate to administer the entire action during a major incident. It also has responsibility for the management of media, hospital information center, and maintenance of hospitals technical needs e.g., water, electric and Information Technology support (IT), management of deaths and finally, the psychological support of victims and hospital staff (2-3, 11). As in prehospital care, the treatment of victims at hospitals follows the principles of damage control. The knowledge in Advanced Cardiac Life Support (ACLS), Advanced Trauma Life Support (ATLS), shock treatment, control of massive traumatic bleeding, diagnostic and therapeutic measures in thoracic injuries, abdominal injuries, pelvic fractures with retroperitoneal massive bleeding, skeletal trauma, CNS trauma, burns, frostbites, cardiovascular trauma, urogenital trauma, crush injuries, blast injuries, surgical infections are necessary and must be adequately conducted. Special attention should be made to chemical poisoning, infectious diseases, epidemics, terrorist incidents, irradiation, biological weapons, and basic principles of Tactical Medicine (8, 10-11, 13).

Conclusion

Management of medical issues and complications caused during disasters and emergencies require a good familiarity with the sequence of medical activities from the initial call to emergency services, arrival and activities on the scene, transportation of the victims to the secondary level, and in-hospital activities. It is also crucial that all the medical staff is skilled in emergency medical management of the victims according to their national/international guidelines.

The non-medical aspects of disaster and emergency management influence the outcome of the medical management and are highly dependent on a solid command with the ability of control, collaboration, coordination and vital decision-making. A continuous interagency and dispatch coordination, media management, security installation, and demonstrating a capability of overall assessment of the entire incident are decisive for the outcome of emergencies. These functions are in need of a good communication and information capacity towards other agencies, staff and victims and necessitate good understanding of the ethical and moral issues that may appear during management of emergencies. Coordination and hospital cooperation is only possible with a rigorous communication system capable of reducing frequent communication problems. It is important to remember that a high level of hospital preparation does not depend only on the technical skills of the operators but also overall ability to cooperate in an unusual and reorganized environment. For this reason, it is highly recommended to test and improve hospital capacity through regular drills and simulation activities (12).

Take-Home Messages

- Both medical and non-medical aspects of emergencies are crucial for the successful outcome of disasters and major incidents.
- Establishing command and control, solid communication, collaboration and coordination capabilities are all necessary to obtain a clear and overall assessment of the incident and the hazards involved.
- Additional skills in triage, treatment options, transport capabilities, and ethical and moral dilemmas related to medical decision-making are necessary elements in medical management of major incidents.

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Chapter 21

CBRNE (Chemical, Biological, Radiological, Nuclear, Explosive)

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Summary

CBRNE covers a vast area of knowledge, which cannot be taught or learned in a few days. Fortunately, CBRNE issues during disasters are rare. However, there are some vital issues, which might arise during management of CBRNE events, and which should be emphasized. When considering strategies for preparedness against CBRNE incidents, the possibility of a low-probability catastrophic outcome must be weighed against public health hazards of higher probability but smaller magnitude. It would be irresponsible to be complacent about the possible effects of deliberately released biological or chemical agents, but it would also be prudent to not overestimate them. Given the emotional shock of an alleged biological or chemical threat, jurisdictions must at least consider how to address such dangers, should they occur, as a part of preparing for threats to public health and well-being. The use of PPE, decontamination and psychological follow-up are important parameters of the whole management strategy. The aim of this chapter is to focus on the principal aspects of medical and non-medical issues in case of a CBRNE event. Explosive events will be discussed at greater length in the chapter dealing with terrorism. This chapter also provides the information concerning methods, techniques, and results of available research relating to response to nuclear or radiological emergencies. It also provides a practical systematic method for developing integrated local and national capabilities for emergency response.

Introduction

CBRNE is weaponized or non-weaponized Chemical, Biological, Radiological, Nuclear and Explosive materials that can cause great harm and pose significant threats in the hands of terrorists. Weaponized materials can be delivered using conventional bombs (e.g., pipe bombs), improvised explosive materials (e.g., fuel oil-fertilizer mixture) and enhanced blast weapons (e.g., dirty bombs). Non-weaponized materials are traditionally referred to as Dangerous Goods (DG) or Hazardous Materials (HAZMAT) and can include contaminated food, livestock, and crops. Outbreaks of infectious diseases, such as SARS, or pandemic influenza are examples of naturally occurring biological incidents.

Chemical weapons include toxic warfare agents (including asphyxiating, blistering, choking, nerve and hallucinogenic agents) as well as auxiliary warfare agents (including tear gas, defoliants and inflammatory agents). Examples include mustard gas, tabun, sarin, VX, chlorine, phosgene, isocyanate derivatives, and amine and amide derivatives. Biological agents include bacteria, e.g. *Bacillus anthracis*, *Yersinia pestis*, *Francisella tularensis*; their toxins – *Clostridium botulinum*; viruses e.g. Ebola, Marburg, Dengue; as well as fungi, protozoa and exotoxins. Radiation and nuclear agents are mainly: alpha, beta and neutron (n) radiation; electromagnetic radiation; ionizing radiation: gamma, X-ray (X), cosmic, electromagnetic; non-ionizing radiation: static electric and magnetic fields, electromagnetic fields, and radio frequencies (1-5).

Chemical events

Since the dawn of civilization, chemical materials have been a part of human life. Today, nearly 100,000 different commercial chemicals are known. Several thousand new chemicals are developed yearly. Of these new chemicals, nearly a thousand reach the commercial market. Annual worldwide chemical production is estimated at 400 million tons. Of this production, most are bulk stored and bulk transported. Hence, there is a risk of large-scale release with resulting environmental and health effects. Human toxicity from chemical exposure has been well recorded since the beginning of the industrial age. Recognition and investigation of

those effects have allowed the development of therapeutic interventions. Toxic effects of chemicals may result from exposures to small amounts of foods or medications, or larger amounts resulting from accidental or intentional releases from storage or transportation facilities. The human toxic effects of smaller chemical exposure events have generally been well managed because there are rarely more than one or two patients requiring care at a time. Large-scale exposures vastly complicate the medical response to a toxic chemical event, principally because of overwhelming logistical difficulties (4, 6-8).

A chemical incident can be defined as any event in which individuals are or could have been exposed to hazardous materials that may be harmful to their health. The chemical substances defined as a hazardous material in connection with chemical incidents are inorganic or organic substances (including petroleum-based products) that due to their physical, chemical, and toxicological properties are potentially hazardous to people, animals, and the environment. In the case of the release of a substance, the hazard is marked by four main characteristics besides the released quantity of the chemical: 1) Type of toxicity, 2) Latency of the effect, 3) Persistence of the substance, 4) Transmissibility. From studying the published reports of such incidents, we can learn some important lessons:

- Identify the hazardous material as soon as possible.
- The decontamination of victims prior to leaving the warm zone is essential for the protection of responders and to prevent further spreading of contaminants.
- The fear of exposure to a hazardous material can cause people to panic due to uncertainty; thus, the rescuer can expect an approximately 5:1 ratio of unaffected and affected casualties who require decontamination and medical treatment.
- Secondary decontamination is equally important even after primary decontamination was done to protect rescuers from inadvertent contamination. The majority of victims following an incident will self-present at the Emergency Department without prior decontamination being done. It is prudent to assume patients are contaminated regardless of decontamination status; hence, decontamination protocols at the ED should be followed.

Biological events

Hardly a day passes without new headlines concerning infectious diseases threats. Not all infectious disease threats evolve into outbreaks or major incidents, and not all threats concerning suspected infectious diseases turn out to have infectious causes. Initially, the cause of major incidents is often not clearly identified. This holds true especially for incidents in which symptoms of the affected persons are diffuse, the conditions are undiagnosed, or the hazardous materials involved are not clearly identified. Many incidents caused by material other than biological contaminants are often initially classified as suspected infectious incidents but, when the full picture becomes clear, they are found to have other causes, for example, intoxication by chemical or radiological agents.

One reason for this is that many countries have surveillance systems that are focused on detecting more common infectious diseases, which may constitute major incidents alone or as a part of the consequence of an incident having a non-infectious cause. The infections that follow as a part and are a direct consequence of a disaster may have several different causes, and they can differ depending on how they are related to the primary incident. The primary incident can lead to disruption of the infrastructure in the affected country; which can lead to secondary biological consequences that may arise due to crowding, the collapse of water supplies, deteriorating sanitation and hygienic conditions; etc. Secondary effects can even be seen within medical institutions, for example, because of a decreased capacity to isolate infected individuals (4, 7-9).

The consequences of a terrorist attack using pathogens are difficult to imagine. Since 11 September 2001, the world has had to prepare for potential bioterrorist attacks. The priority has been on developing crisis

prevention plans (particularly against bioterrorist attacks) and procedures for dealing with specific situations: e.g., rules for notification and cooperation in the event of an intentional release of an infectious disease, procedures for handling suspicious shipments, and diagnostic procedures in the event of biological agents being used. These procedures assume the use of standardized diagnostic methods in both BSL-1 and BSL-2 laboratories and in mobile military microbiological laboratories.

Although bioterrorist events have similarities with other disasters, there are still some major differences, especially in the approach to triage management. Conventional mass-casualty events use uniform methods for triage based on severity of presentation, while the bioterrorism triage needs to consider factors, such as exposure, duration, or infectiousness, thereby impeding control of transmission and delaying recognition of victims requiring immediate care. The bioterrorism triage management must be population-based, with the goal of preventing secondary transmission, beginning at the point of contact, to control the epidemic outbreak. Whatever the triage system is used, responders must first recognize the requirements of SEIRV, i.e., those Susceptible but not exposed, those Exposed but not yet infectious, those Infectious, those Removed by death or recovery, and those protected by Vaccination or prophylactic medication (SEIRV methodology).” Everyone in the population exposed falls into one of these five categories.

Radiological and Nuclear Events

Mass exposure to radiation does not occur frequently, but when it does such events present significant logistical, operational, and medical challenges that may be compounded by the lack of familiarity most personnel have with the manifestation and management of radiation injury. Because of the proliferation of nuclear states, the occurrence of at least one well-documented case of smuggling of nuclear technology, the widespread availability of radioactive materials, and continuing concerns about the risk of nuclear or radiological terrorism, the risk of deliberate mass exposure to radiation has likely increased in the recent years.

Major irradiation incidents cause acute injuries and induce health risk among the population in large geographic areas, for example, severe nuclear reactor technology failures in nuclear power plants (Fukushima, Japan). The radioactive material might be released from the reactor and spread over large geographic areas. The radioactive fallout can be a serious danger to the health of the population and can cause severe environmental pollution in the affected areas, with long lasting effects. Minor irradiation incidents can result in acute irradiation trauma to the workers at the site of the accident. The release of radioactive material is usually limited to smaller areas, and the danger to the health of the population and environmental contamination is generally local. For example, there are industries that handle radioactive material, hospitals, and transportation units for nuclear material. There is a difference between being contaminated and irradiated. There is no danger in taking care of irradiated patients, while there are health-related consequences when taking care of contaminated patients (4, 7-8, 10-12).

Explosive events

Blast injuries are caused by rapid pressure waves created by the detonation of explosives that may cause multisystem, life-threatening injuries in single or multiple victims simultaneously. Indoor explosions cause the most severe injuries and have the worst outcomes. Survivors have predominantly primary and tertiary blast injuries. Secondary blast injuries may occur due to suicide bombings in open and/or semi-confined spaces. Life-threatening injuries involve lungs and hollow viscera. Limb injuries are rare in civilian settings and are mostly caused by a secondary blast effect created by projectiles and shrapnel implanted in explosive devices. Blast injury associated with the skeletal damage may involve multiple skeletal sites and organ systems. Non-operative management and damage control techniques together with tertiary surveys to identify missed injuries are part of the treatment regimen (4) (for further information, please refer to chapter 27).

Management of CBRNE incidents

Taking command

A CBRNE-Incident should be considered when faced with the following scenarios (12-13):

- Multiple victims, including the first responders, with similar signs and symptoms involving the skin, respiratory system, eyes, and sensorial changes;
- Co-existence of sudden death of surrounding animals (such as birds);
- Increase in the frequency of those with the aforementioned signs and symptoms in the direction of prevailing winds;
- Unusual explosions containing bright-colored vapor clouds with unexplained odor or taste;
- Mass casualties from explosions with unusual or unexplained presentations and or without any conventional injuries.

Leaders should consider the following questions as part of the scene size up:

- What is the main problem?
- How will the mass causality incident be managed?
- Which agencies should coordinate the entire incident response?
- How can the victims (and deaths) be sorted out?
- Is the scene safe and are responders accounted for?
- What are the medical treatment implications?
- Are there any antidotes, antibiotics or vaccines available?

The commander in charge in collaboration with other agencies should make decisions. Principles of MCI-management should be applied as part of pre-incident planning. Although some reports suggest decontamination before triage, this issue may be discussed and procedures may differ in each situation. Many people in a mass casualty incident, as well as, CBRNE events, may have minor injuries. However, even those with minor injuries in a CBRNE event should be evaluated and treated, including providing psychological support. A physician who is familiar with CBRNE should see every patient, including health care providers, with symptoms (1-3, 12-13).

Personal protective equipment (PPE)

Personal protection is deeply inculcated in the education of rescue workers (1-2, 6). All rescue workers have to take care of CBRN- and non-CBRN patients in prehospital setting but need to be aware of the fact that any contamination inside the hospital should be avoided for taking care of non-protected staff and other patients. Personal Protective Equipment (PPE) should be available for all healthcare providers who have contact with contaminated patients. All responders must be trained to wear appropriate PPE in order to protect themselves before entering a contaminated area. It is important to monitor the health and wellbeing of those who are wearing PPE due to the following limitations: restriction of physical activity, dehydration, heat-related illness, and potential psychological effects. There are many existing classifications of PPE. One common classification system is outlined below.

- Level A PPE; denotes fully encapsulated suit, with over-gloves and over-boots integrated into the suit. Respiratory protection is a self-contained breathing apparatus. Level A protection is required for entry into areas known to be hazardous or suspected/unknown-hazard environments.
- Level B PPE; denotes a hooded suit, double gloves, overboots, and a self-contained breathing apparatus, and may be used for decontamination procedures for an unknown substance and for entry into hot zones where the agent is not caustic.

- Level C PPE; is similar to Level B, but uses an air-purifying respirator instead of a self-contained breathing apparatus. Level C PPE can be used only after the hazardous substance has been identified, and upon verification of adequate oxygen in the environment.

It is the duty of the person responsible for staff safety to consider which protection is appropriate for each response phase. For any unknown incidents, the minimum level of protection should be level A at the impact site/hot zone, and at least level B at the warm zone.

Triage

Who is to be treated first? This question should be answered after appropriate triage. There are many triage methods with pros and cons for each. During a CBRNE event, triage systems such as STaRT, “sweeping triage”, and the triage system used in traumatology have been suggested.

Although no system has been validated for CBRNE circumstances and no method has shown an improvement of survival, the best way might be to use a simple triage method that can be used both in prehospital and hospital settings (7-8, 14). The rapid advances in the field of CBRNE challenge all triage systems and training. Triage will occur at multiple sites along the continuum of care, which is a characteristic of all CBRNE events.

Decontamination

Decontamination is the reduction or removal of contaminating material by dilution, chemical, and/or mechanical processes. It should be performed whenever there is the likelihood of contamination or risk of secondary exposure. In general, decontamination is accomplished by removing the victim’s clothing followed by copiously rinsing the patient with tepid water. Gently scrubbing the skin with soap and a soft brush removes any remaining fat-soluble chemicals and solid materials. Eliminating contaminants from a victim’s skin and clothing is important for two reasons. It reduces the risk for further absorption or inhalation and the subsequent toxicity caused by the offending agent. In addition, decontamination helps to prevent others from becoming secondarily exposed or contaminated.

Those contaminated with liquids or solids require copious skin lavage and wound irrigation with water within minutes of skin contact to minimize the degree of injury. Rinsing the patient with a high-volume, low-pressure water source dilutes, neutralizes, and helps rid the skin of reactive surface contaminants. In the case of corrosive agents, decreasing the duration of skin contact helps restore tissue to its normal pH, thereby minimizing the incidence of full-thickness burns.

Using soap to emulsify fat-soluble agents and a soft brush to remove mechanically any remaining solid materials is also beneficial. Soap and water decontamination, although ideal, might slow the decontamination process, delay transfer from the scene, and utilize work force that more appropriately might be directed towards the rescue and care of the non-ambulatory survivors (15).

Psychological support

All communities exposed to disasters experience multiple traumatic events including threats to life, loss of property, exposure to death, and often economic devastation. Disasters by definition overwhelm institutions, healthcare, and social resources and require months and even years of recovery for both individuals and communities. Characteristics of the event may greatly increase the stress experienced, such as a lack of familiarity with the prevailing hazard, use of fear as a weapon, intensity of impact, the predictability of the event, (16). Many responses to trauma and disasters (with or without CBRN-issues) can be expected, but the following symptoms signal the need for further evaluation by mental health and other medical and human service professionals;

- Disorientation (dazed, memory loss, inability to give date/time or recall recent events).

- Suicidal or homicidal thoughts, plans, actions.
- Domestic violence, child or elder abuse/neglect.
- Acute psychosis (hearing voices, seeing visions, delusional thinking).
- Inability to care for self (not eating, bathing, changing clothing, or handling daily life).
- Severe anxiety (constantly on edge, restless, obsessive fear of another disaster).
- Problematic use of alcohol or drugs.
- Depression (pervasive feeling of hopelessness and despair, withdrawal from others).

Management of the Dead

CBRNE incidents may lead to a large number of fatalities. The presence of dead bodies exposes fears and creates confusion among responders, leading to ineffective and misguided attempts to appropriately manage mass fatality events. Mass fatality management is a process designed to ensure the proper recovery, handling, identification, transportation, tracking, storage, and disposal of human remains and personal effects. These should include the following steps: 1) identify the type of agent or hazard present, 2) implement the fatality plan together with forensic responders, medicolegal authorities and sanitary engineers with appropriate PPEs, and 3) identify a morgue that is separate from the medical post or hospitals. For certain chemical and biological agents, there are considerations regarding burial or cremation of remains, which should be coordinated with public health officials. All clothing should be removed from the victim, including shrapnel that may contain chemical, biological or radio-nuclear agents. Most remains can be washed with water. Monitoring of symptoms from those processing the bodies using diagnostic tests or devices (e.g., Geiger counter, chemical detectors, swabs, etc.) should also be emphasized (1-2, 17-20).

Risk Communication and Dealing with Media

CBRNE events may trigger public anxiety and fear to a degree that is strikingly disproportionate to the number of deaths. Furthermore, the media appears to be a primary contributor to this public anxiety, largely because of its presentation format. This will create a vicious cycle, and may exponentially increase the public's demand for timely and accurate information. The medical community should anticipate this need for information, develop public advisories, and risk communication strategies for early implementation during such an event. In addition, they should help to ensure that the media conveys an accurate and representative story (1-2, 17-18).

Documentation

Aside from communication, documentation is also one aspect that is often neglected by medical professionals during large-scale disasters such as CBRNE. Chaos and panic from the responders and even medical professional may result due to poorly constructed reports and inadequate documentation of events, eventually leading to poor recovery efforts and limited debriefing and incident evaluation. Documentation is important in terms of archiving, creation of after-action reports, and development of corrective action plans. To avoid situations with insufficient documentation, members of the medical records staff must be part of the planning process, including disaster drills, triage and treatment units, and debriefing. The staff should prioritize identifying and locating victims, provide accurate up-to-date lists of all patient admissions, discharges, and destinations. One must take note that there is a fine line between inadequate documentation that provides no useful information, and excessive documentation, which can slow response efforts. The use of checklists and simple forms may streamline effective documentation on-scene (1-2, 17-20).

Conclusions

CBRNE covers a multitude of medical and non-medical aspects. An effective CBRNE response requires a multi-sectoral approach and inter- and intra-network collaboration, which includes extensive planning and

rigorous operational training. This chapter highlighted the important points; responders must consider during an incident, with a special emphasis on triage, decontamination, and psychological support. (1-3, 6, 18-20). The advancements in disaster risk reduction and management has resulted in the need to plan for all aspects of CBRNE, including prevention, mitigation, response and recovery. Traditionally, the medical community has focused primarily on immediate response to a CBRNE event. With experiences gained from the Tokyo Subway Incident, September 9/11 attack, and recent SARS-CoV-2 pandemic, it is evident that a focus on the broader aspects of an event is necessary. Recently, Coleman and colleagues (16) proposed seven core elements describing specific skill sets needed to promote integration and collaboration among the key stakeholders, together with senior decision-makers during response operations. Furthermore, they have coined the term CBRNE medical operations science support expert (CMOSSE) as the lead expert alongside the focal person in command during the incident. The CMOSSE would act as experts from the designated public health or medical emergency disciplines (e.g., toxicologists for chemical incidents) that will provide medical information and guidance during the development and implementation of tactics and strategies during response. The core elements proposed by Coleman et al. are:

- Dedication to rigorous, ongoing **basic and clinical sciences**, including development and plans for effective utilization of Medical Counter Measures (MCMs)
- Detailed **modeling of CBRNE threats with a systems approach**, before, during (where feasible), and after specific incidents and exercises
- Creation and use of **all-hazards plans** to serve as a foundation that incorporates detailed planning modifications required for specific CBRNE threats
- Training and deployment of sophisticated **response and incident management** personnel cognizant of specific CBRNE issues and the need to embed a CMOSSE near senior incident commanders and senior decision-makers early in and throughout response to an incident
- Development of **recovery and resilience** plans accounting for specific CBRNE effects as well as psychosocial impacts on communities
- Commitment to realistic and honest assessments of **lessons learned** both from previous incidents and from exercises
- Commitment to **continuous improvement** based on new knowledge from the intelligence community and scientific and clinical medicine communities and on experience gained from exercises and actual incidents

Take-Home Messages

- CBRNE is a broad subject that needs dedicated training for emergency planning and response.
- Application of MCI-Management due to its similarity to CBRNE events with emphasis on protection.
- Understanding the unique aspects of the individual components of CBRNE enables contextualized planning and response at local and national level.
- Multiagency collaboration and coordination with those involved in the incident command structure, as well as, stakeholders and technical specialists guiding the responders is imperative at the beginning of the response.
- All responders must act appropriately to protect themselves with the use of level-specific PPEs before entering the contaminated area.
- Whenever there is the likelihood of contamination or risk of secondary exposure, all patients should be decontaminated.
- Triage should be conducted according to a designated hospital protocol or specific triage methods; otherwise, the best triage method for CBRNE is a simple triage that can be used in both prehospital and hospital settings.
- Provide psychological support to those affected by the disaster, including responders if needed.

- Management of the dead, risk communication and documentation are neglected aspects of CBRNE response requiring additional emphasis during planning, response and evaluation.

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Chapter 22

MENTAL HEALTHCARE AND PSYCHOSOCIAL SUPPORT

Cave Sinai

Summary

There is a remarkable mental resiliency in humans exposed to disaster. Many of the psychiatric symptoms are normal responses to an unnatural event and decline gradually. For some, the mental outcome may become a significant burden, and, from a global perspective, the mental health support is extremely different depending on the economic prosperity of the country. A coordinated approach linking national medical care, public health systems and emergency aid is vital to match the mental health care needs in the disaster region.

Introduction

Different mental health capacities

Given the global ample range of different economical and structural capacities among countries, the impact of mass-disasters renders different outcomes in the mental health consequences for the community. In the post-disaster time-span, industrialized countries with a reasonably adequate functioning mental health care may have a reasonable capacity to treat and support the individuals in most need. In contrast, in some low-income and middle-income countries, even the basic prerequisites for mental health care are not yet established and accounts for a substantial burden of disease and costs. Moreover, impaired mental health is related to both poverty, physical illness, lack of education, gender inequality and violence. Thus, although the individual neurons in the human brain expresses similar mental, social and cognitive responses to disasters globally, the organized mental healthcare for identification, coping and treating mental health outcomes, varies considerably among countries. The mission for treating psychiatric outcomes after a disaster reaches beyond the specialized mental health professionals and is proposed to be essential also for the public health planning (1).

Disasters may enhance mental health infrastructure at the end

Although there may be a lack of developed psychiatric care facilities in any region, there are great opportunities to create or empower these mental health services in the disaster aftermath. This has been observed in the ongoing Syrian conflict, where mental health now has nationally expanded beyond the mental health facilities formerly only provided in Aleppo and Damascus. After the typhoon desolated parts of Philippines in 2013, 100% of mental health facilities in those troubled regions now have trained mental health management personnel, in contrast with only two facilities prior to the disaster (2). In Sri Lanka, by the aid of WHO (World Health Organization) and later on also World Psychiatric Organization (WPA), as of 2011, 75% of the country's districts offer inpatient units in general hospital settings that helps expansion of basic and specialized mental health services, as compared to only 40% before the 2004 tsunami (3). In regions with recurrent disasters, the role and influences (4-5) on preparedness has been investigated, and the responsibility for regional resilience may also be outlined in the legislation (5).

The nature of the burdened population

In any affected region, both individuals with no prior mental health problems, as well as more vulnerable individuals with any mental disability or prior psychiatric diagnoses, meet the burden of stress. The majority of normal reactive mental symptoms after a disaster are self-limiting among the non-vulnerable population reflected by the robust resiliency expressed in different human social communities exposed to disasters (6-9). Caution must therefore be taken not to medicalize nor pathologize normal human stress-related reactions,

psychiatric symptoms, or natural anxiety reactions, that rapidly decline over time, although the pattern of decline is not as yet established (linear decline, or initial decline followed by a stabilization phase). On the other hand, priority need to be taken for especially vulnerable individuals, some with both less autonomy in combination with mental illness. A subset of the psychiatric patients are in direct need of sustaining their pharmacological treatment ongoing and need to be prioritized (10-11).

Prioritized populations

These include individuals, with regular treatment with antipsychotics and lithium (in countries providing regular open-care or primary care treatment), especially for patients with Bipolar type I. In disasters, psychiatric vulnerability is more prominent among individuals with anxiety disorders, somatoform disorders, mild to severe depression and posttraumatic disorder (12).

Types of disasters

One way to categorize disasters is by definition of their causes. Nature or humans (manmade) can cause disasters (13). This divide may also be difficult to draw since humans may accelerate the process in some cases. Natural causes, such as earthquakes, storms, tsunamis, cold waves or blizzards, may also include climate change, causing heat, fires, drought, humidity, heavy rain, flooding (14). The natural causes affect the mental health by direct pathways (traumatic exposure to specific event, with acute stress and grief responses) or indirect pathways (poverty, unemployment, lack of means or plans for disaster housing recovery) (15). The indirect pathways may contribute to more complex psychiatric consequences, ranging from general depression to exhaustion and drug abuse.

Climate Change and mental health

Temperature levels is an extensively studied facet of hazards and disasters, with indications of positive correlation to poor mental health outcomes, independent from established mental health problems (14). Climate change is not only associated with general psychological distress, but also enhancing existing inequalities (16), psychiatric hospitalizations, elevated suicide rates and mortality in mentally vulnerable populations (15). The elevated temperature is especially hazardous in such countries as Democratic Republic of Congo, Haiti, Angola, Liberia, South Sudan, Nigeria, Pakistan, and Yemen (17) due to enduring conflicts, low crop production with low ability to mitigate the impacts and food security crisis. Food supply in Yemen largely depends on imports, but drought conditions add pressure to the ongoing food security crisis. The most prominent causal pathway linking drought and mental health is via the economic effects from land degradation (16). Individuals with thermoregulation difficulties are especially vulnerable in combination with medications, such as lithium, antipsychotics, or anticholinergics. Manmade disasters in recent human history include nuclear testing, nuclear reactor meltdowns, gas leaks and oil spill rendering many fishermen without their livelihood, smog in major cities forced migration and civil conflicts. Anthropogenic (man-made and caused by human action or passivity) hazards include terrorism, war, crime, cyberattacks, biological/chemical attacks. Whether the extent of spread and seriousness of the COVID-19 pandemic has been facilitated by humans, due to lack of equal vaccine distribution among countries, insufficient state-regulations or unsatisfactory communication to citizens, or nation-specific non-adherence to population recommendations, still have to be investigated.

General mental health consequences after mass disasters

General symptoms after mass disasters are loss, grief, panic, sadness, fear, sleeping difficulties, anger, irritability and guilt, including “survivor’s guilt”. Among the more common mental outcomes after mass disasters are anxiety and generalized anxiety disorder (GAD), depression, panic disorder, Post Traumatic Stress Disorder (PTSD) and suicidality. Some barriers for seeking mental health care and areas of focus for governments in alleviating disaster-related mental health problems are:

1. Lack of professional mental health providers, ability, education, and expertise in mass disasters. For example: general knowledge of cultural aspects of rape, perpetrator and victim differentiation as seen in post-conflict in Rwanda or treatment of family violence (17)
2. Cultural taboos and stigma
3. Lack of means for using healthcare or fear of accessing services due to harassment risk
4. Distrust or inability to grasp the usefulness of mental health care
5. Availability of psychopharmacological substances in the region
6. Lack of the national psychological/psychiatric response plan and incident management plans

Due to diverse and sometimes competing mental health aid groups (national or international) or organizations in mass disasters, the national psychiatric response plan should be aligned with other significant national disaster response plans, along with a clear communication plan for responders at all levels, to facilitate collaboration in crisis. Moreover, it is of a great importance helping communities to stay informed and disseminate credible information.

Skills needed in approaching afflicted persons in disaster

Overall, there is no general or universal recipe for approaching, evaluating, supporting, treating, and following up persons in extreme disaster. There are many factors to be taken into account, such as timing of approach, psychocultural aspects, amount of traumatization, special social and cultural dimensions that may be very specific for the region (20). For external and foreign helpers, tact and wisdom are of a great importance, and a thorough knowledge of the cultural habits and history may be essential for reaching out with efficiency. What may be of the deepest respect for one culture, may not work in other countries. Approaching Yazidis in Iraq after the genocide in recent years may need one type of approach and delicacy, for example in meeting with the traumatized and raped females. Approaching people surviving the Luoyang Christmas fire in the year 2000 (killing > 300 people) may need another methodology. In extreme desperation, humans have also shown a remarkable ability to give support to each other without specialized skills. In summary, the contextualization of psychological first aid is essential (21) for tailoring the support to the specific needs in the tormented region.

Mental care of humanitarian aid workers

The greatest gain in organizing and assuring at least a basic level of support for aid personnel is to create and continually evaluate a trusted agenda for organizational psychosocial and mental health program. For an excellent review, the interested readers can refer to the Special Report: “Humanitarian Aid Workers: The Forgotten First Responders” (22). It is also worth considering dealing with moral stress and survivors’ guilt in addition with fostering the level of acceptance for the aid being possibly given in times of an overwhelming and chaotic milieu.

Mental health approach in disaster

A disaster may override preexisting mental health care capacity, and assistance from nearby regions or countries may be needed. A distinction in approach can be made between:

- a) specialized psychiatric interventions as well as the ambition to minimize service disruptions (23) for individuals with known prior psychiatric diagnoses, in contrast to
- b) interventions for the general population: for example, Mental Health First Aid training (24), which has been spread to more than 22 countries, although with ambiguous evidence of efficacy (25) with the need of reconceptualization (26); or Psychological First Aid (PFA), which is an evidence-informed modular approach to individuals of all ages and families, intended for the immediate aftermath of exposure to disaster and terrorism.

The eight *PFA* core actions includes:

- Contact and Engagement. Nonintrusive, non-judgmental, and helpful listening and response without making assumptions
- Safety and Comfort. Protection from stressors
- Stabilization & self-regulation. Aiding the affected person to recognize emotional reactivity
- Information Gathering on Current Needs and Concerns
- Practical Assistance
- Connection with Social Supports
- Information on Coping
- Linkage with Collaborative Services

WHO has provided a document on Psychological First Aid (PFA) translated into 33 languages (27), and there is also a PFA-app to download (28). Some countries have ambitions to establish “Information and Advice Centers” (IAC), but this is not globally practiced. The International Society for Traumatic Stress Studies (ISTSS) has published a guideline document for preventions and treatment guidelines for PTSD (29-30). The disaster approach can also be categorized into prevention, preparedness, response, and recovery (PPRR), established in many countries, but has been challenged and extended with anticipation and assessment of threats (31).

Significant global actors in psychiatric disasters

The WHO is the prime agency in offering advice on mental health emergencies. Other significant advocates for mental health are United Nations (UN), UNICEF, WHO, WPA and the World Federation for Mental Health (please see chapter 7).

International agreements in mental health proliferations

- The Sendai Framework for Disaster Risk Reduction 2015-2030 (UN World Conference in Sendai, Japan, March 18, 2015) states: to enhance recovery schemes to provide psychosocial support and mental health services for all people in need (32).
- Sustainable Development Goals 2016–2030 (UN); Envision2030 Goal 3: Good Health and Well-being (33)
- Movement for Global Mental Health, is an international coalition of individuals and institutions, aiming for enhancing treatments and human rights for individuals with mental disorders (34).

Conclusions

An optimal mental health approach in disasters operates through local, regional, or national aid systems, due capable culture-specific knowledge and information on the special needs of the afflicted population. When these systems lack resources, international aid could best intervene when being thoroughly informed of the background characteristics of the mass-disaster region. Normal reactions to unnatural events ought not be medicalized nor pathologized. Mental care of humanitarian aid workers should not be overlooked. Anticipation of global climate change should not overlook mental health consequences, especially in developed countries.

Take-Home Messages

- Humans have a general ability to self-heal and naturally handle extreme stresses. Thus, caution must be made not to transfer a normal reaction to an abnormal one.

- There is no cookbook approach how to approach people in disasters. An individualized approach with culture-specific knowledge is essential.
- Mental health plans should as far as possible be synchronized with governmental or local crisis plans to reach people in need.

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Chapter 23

VULNERABLE POPULATION

Amir Khorram-Manesh, Eric Carlström

Summary

Anyone exposed to a disaster will be hurt; however, the physical and psychological consequences of such trauma are more prominent in people who belong to any of the vulnerable groups. There are many vulnerable groups in a society with various needs. In general, women, children, elderly and disabled people are more vulnerable to the outcomes of a disaster or a major incident. The result would be a lower capacity of adaptation and survival in the given emergency, which also mandates a better planning for protection and rehabilitation of these groups immediately after disasters. Additionally, vulnerable groups may face several other issues during and after an emergency, which increase their risk for psychological and somatic symptoms such as abrupt onset of intense fear, vertigo, insomnia or even psychoses. Consequently, there is a need for psychological, as well as, physical and economic rehabilitations measures to allow vulnerable population to adapt and cope with the disaster. Knowledge about their presence and management of their situation is of high importance in a disaster situation or at the time of a major incident. The aim of this chapter is to raise awareness about existing problems with management of vulnerable groups and the ethical and legal perspectives that may emerge in disasters with regard to resource allocation for vulnerable populations. It also aims to emphasize the importance of planning for these groups.

Introduction

The degree to which populations are vulnerable to hazards is not solely dependent upon proximity to the source of the threat or the physical nature of the hazard; social factors also play a significant role in determining vulnerability. Members of “Vulnerable Groups” are those individuals at the greatest risk of disease or injury within a population. There are many reasons why individuals or groups are particularly vulnerable. However, various studies have suggested that pre-existing socio-economic conditions play a significant role in the ability for particular economic classes to respond immediately to the disaster and to cope with its aftermath (1-7). Although there is not one universally accepted definition of vulnerable populations, from a public health perspective, the vulnerability can be defined simply as an increased potential for loss in a hazardous situation, including reduced capability to respond effectively. Some might be vulnerable because they are given less priority for limited resources, or belong to an ethnic, social, religious or political minority or have greater difficulty accessing treatment and care (2).

Vulnerable groups include but is not limited to (1, 5-11):

- Women (e.g., pregnant women, mothers, single mothers, widows and, in some cultures, unmarried adult women and teenage girls).
- Children (from newborn infants to young people 18 years of age), including separated or unaccompanied children (including orphans), children recruited or used by armed forces or groups, trafficked children, children in conflict with the law, children engaged in dangerous labor, children who live or work on the streets and undernourished/under stimulated children.
- Elderly people especially when they have lost family members who were caregivers.
- Poor people.
- Refugees, internally displaced persons (IDPs) and migrants in irregular situations.
- Physically and mentally disabled people, those living with HIV/AIDS, those with special treatment needs such as advanced healthcare at home.

- Population in disaster intensive areas, such as earthquake intensive areas, areas exposed to flooding, landslide, terrorism etc.
- The population exposed to extreme weather conditions, such as heat, cold, extreme weather, etc.

For an influenza pandemic, for example, a useful framework for defining and identifying sources of vulnerability considers the likelihood of exposure, of contracting the disease, and of treatment. Health disparities, differences in treatment access, living conditions, health literacy, risk perceptions, and confidence in the government's ability to respond could exacerbate risks for particular populations (4). Mortality rates among young children are higher than the crude mortality rate among the whole population in emergency settings, so attention is focused on this age group. However, even under normal conditions, mortality is higher in young children (6). The vulnerability of the elderly to disasters is related to their impaired physical mobility, diminished sensory awareness, chronic health conditions, and social and economic limitations that prevent adequate preparation for disasters and hinder their adaptability during disasters. Frail elderly, those with serious physical, cognitive, economic, and psycho-social problems, are at especially high risk. This segment of the population is growing rapidly. Therefore, it is important that emergency management recognizes the frail elderly as a special needs population, and develop targeted strategies that meet their needs. Several management strategies are presented and recommendations for further action are proposed (12).

Prevention measures

Long-term predictions about the anticipated general location of a forthcoming earthquake have proven to be useful. Early warning of drought, cyclone, and flood is reducing the vulnerability of communities previously at risk and significantly reducing deaths and injuries. Peer relationships are a valuable mechanism for facilitating cooling behaviors among the elderly during heat events. To prevent disparities in heat morbidity and mortality in an increasingly changing climate, heat preparedness plans, interventions, and messages are considered as fruitful. Decision-making related to commonly promoted behaviors, such as air conditioner use and cooling center attendance, is complex, and these resources are often inaccessible financially, physically, or culturally (13-14). When addressing preparedness for vulnerable people, community-based organizations are often underutilized resources. They traditionally have a special commitment to locate and reach such at-risk individuals to provide human services while accommodating individual needs. They offer day-to-day services and often have earned the trust of the people they serve. Hence, they can also help to provide accurate post-disaster needs and mobilize the community and local resources in crises (1-3, 15-18). Previous reviews have indicated the need for different programs of physical, physiological, economic and social rehabilitations for vulnerable groups, irrespective of types and background to help health field managers better understand and implement standard rehabilitation activities for vulnerable groups after emergencies and disasters (18).

Conclusion

The vulnerable population severely suffers from the consequences of a disaster or an emergency. Although several management systems identify this vulnerability through the RVA analysis, necessary measures for this group of people before and during phases of emergencies is missing. Avoiding a severe impact on this population, sufficient planning should be conducted to protect their lives and save the mental and physical costs that can incur.

Take-Home Messages

- Vulnerable population should be identified through RVA.
- A multidisciplinary group should offer sufficient and adapted solutions to vulnerable population.

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Chapter 24

TERRORISM PREPAREDNESS AND CRITICAL INFRASTRUCTURE

Attila J. Hertelendy, Amir Khorram-Manesh

Summary

A new era of terrorism creates new challenges and calls for multidisciplinary management of terrorist attacks. Civilian-military collaboration together with terror medicine are the key components of such management and consist of many stages before, under and after any attack. Preparedness, planning, command, control, communication and collaboration are all necessary parts of disaster management and also applicable to any terrorist attack. All these components are a part of a chain of actions that starts with vital decision-making and utilization of all needed resources. In order to manage the situation in harmony between all agencies involved, multidisciplinary training should be conducted frequently, and standardized and mutual protocols for risk and resource assessment should be created. Regularly scheduled exercises and virtual reality simulation remain a key strategy to enhance resiliency and promote preparedness. The aim of this chapter is for the reader to understand the basics of terrorist tactics, procedure, and techniques, which will form the basis for the basics of terrorist incident response management and of terror-response medicine.

Introduction

Terrorism has been defined as the unlawful use of violence and intimidation, especially against civilians, in the pursuit of political aims. In general, terrorist groups commit their acts of violence to produce widespread fear as a means to obtain local, national and international attention and recognition, to harass, weaken or embarrass government or government-related organizations in order to affect a country's economy or have an impact on political decision-making. The ideology and motivation behind terrorist acts influence the targets of terrorist operations, especially regarding the number of casualties. As a rough rule-of-thumb, purely political groups have very selective goals to achieve their political aim. For these groups, the number of deaths matters, since killing a high number of innocent people will not serve their political goals. Ideological groups (religious, ethnic, or ideational) might aim to hurt as many victims from among the target population as possible, either because they have dehumanized their target population, or possibly due to an apocalyptic frame of reference they adhere to in their ideology (1-2).

The ideology of terrorism has shifted in the twenty-first century from socio-political ideologies, such as communism and anarchism, to a greater emphasis on nationalism. Terrorism's modern version was formed after the Second World War and the rise of nationalist movements in the old empires. In Europe, terrorist attacks have become more common. They may occur anywhere, even in countries where terrorism was not common before. Terrorist events require an immediate response in the form of disaster management. When terrorism strikes, overburdened healthcare systems (notably those undergoing radical reduction of emergency hospitals and hospital beds due to economic cost-cutting), over-utilized EMS (Emergency Medical Services) and sub-specialization of the medical profession, will be challenged both medically and organizationally (2-4).

There are many types of terrorist incidents. The most common include bombing and arson, armed attacks and assassination, kidnapping, hostage taking, hijacking and skyjacking, cyber terrorism and CBRN attacks. The current approach to the terrorism analysis involves an examination of individual terrorists or terrorist organization's use of particular weapons, used in specific ways, and the tactics and strategies being exhibited. These TTPs (Techniques, Tactics, and Procedures) of terrorism have historically exhibited a wide range of options by individual terrorists, or terrorist organizations. They appear worldwide because TTP are often transferred between various terrorist groups. The worldwide evolution of TTPs depends on changing circumstances, resource availability, and changing ideologies, or 'war-focus' (5). A common recent worldwide

TTP seems to be mass casualty attacks by suicide bombers. Recent terrorist attacks in Europe using heavy trucks as a weapon show changes in tactics and the main question is what is to be expected next. The knowledge used by terrorists come from two sources; 1) *Explicit Knowledge* is the theoretical information which is often stored in hard copies, such as textbooks, manuals, and video files. This is extremely easy to get hold of, but without the appropriate teaching or experience, is commonly not effectively used. 2) *Tactical Knowledge* is most commonly taught, or learned, through experience and hands-on teaching. This requires training establishments and although more effective, is harder, and more difficult to obtain and transfer (5-6).

Recent video materials published by terrorist organizations through the internet clearly show terrorist training camps in which children train to become the next generation of terrorist fighters. These are a serious threat to the future. Training children as future terrorists seem to be a crucial measure for existing terrorist groups to secure their long-term success. Acquiring deep knowledge, and the deep indoctrination and desensitization since childhood, enable the group to consider themselves as better and more dangerous fighters. This includes a systematic process of indoctrination as the children are trained to be fully-fledged operatives. Growing up without joy, tenderness and without the possibility of experiencing a child's normal environment, they will learn that suffering, violence, death and despair are a normal way of life. We cannot predict nor imagine what the consequences of this program will be in the near future and when the Lost Generation starts having their own children. Today, there is no comprehensive strategy in place for rehabilitation and re-education of the Lost Generation. In order to deal with the tragic consequences of this project, governments need to develop long-term strategies with a multiagency approach (2-3, 5-6).

A new field of medicine has emerged because of the global proliferation of terrorism. An understanding of the broader application of intent, violence and healthcare impact is known as Counter Terrorism Medicine (CTM), which provides the necessary understanding of how terrorism and its affects influences the healthcare setting (7-9) The field encompasses four broad areas: *preparedness, incident management, mechanisms of injuries and responses, and psychological consequences*. Other important criteria for a successful management of a mass casualty event, e.g., command and control, communication, coordination and collaboration and logistic must be learned as well (7). Major points to be planned for a successful management of a terror attack are:

- National/regional/local disaster plans to help mobilizing hospital, prehospital and remote resources Quick and vital decision-making by incident command officer to initiate the plan
- Medical and non-medical management plans including (6)
 - a. Simple triage (prehospital and hospital) and
 - b. The use of damage control strategy
 - c. Quick transport of victims in small groups to the appropriate hospital
 - d. Quick identification of victims and utilization of provisional identification cards, and
 - e. Continuous training in a multidisciplinary setting including creation of common protocols and guidelines

Mass terror attacks call for a new approach to terrorism preparedness of the civilian population. From a military perspective, the effective transportation of forces and military equipment relies on civil resources and infrastructure, such as railways, ports, airfields and roads. The military relies on basic government functions in order to facilitate and protect these vulnerable assets, which can be targeted by an external attack and internal disruption. Civil preparedness facilitates good organizational and functional basis during emergencies or disasters in peacetime or in periods of crisis.

Civilian preparedness also means that civilian organizations are to cooperate with the military and are supposed to give the military necessary support when needed. This will be more evident in the healthcare sector, where in many countries military hospitals and internal resources have been reduced in order to support military actions abroad. The potential for cooperation from the military to civilian agencies have been met with some skepticism from the civilian side, which has been under constant resource reduction due to constraint economics (10-12).

Depending on the type of terrorism injuries, the physical and medical outcome will be different. In the new era of terrorism, the most common injuries to the civilian population consist of blast injuries and multiple gunshots. Blast injuries are caused by rapid pressure waves created by the detonation of explosives and cause multisystem, life-threatening injuries in single or multiple victims simultaneously. Indoor explosions cause the most severe injuries and have the worst outcomes. Survivors have predominantly primary and tertiary blast injuries. Secondary blast injuries may mainly occur in suicide bombings in open and/or semi-confined spaces. Life-threatening injuries involve lungs and hollow viscera. Limb injuries are rare in civilian settings and are mostly caused by a secondary blast effect created by projectiles and shrapnel implanted in explosive devices. Blast injury associated with skeletal damages may involve multiple skeletal sites and organ systems. Non-operative management and damage control techniques together with tertiary surveys to identify missed injuries are part of the treatment regimen (3-4, 13-18).

Low or high velocity energy delivered by a gunshot, can result in a multimodal injury sustained to the vital organs. The impact of the bullet on tissues is characterized by a cavitation process or direct delivery of energy. Muscles, bone, and blood vessels are mainly affected in the limbs. Almost all high-energy gunshots are considered contaminated and should be treated accordingly. Stabilization of bone, soft tissue care, adequate wound coverage, and restoration of limb function are important parts of the treatment strategy. Bone loss and soft tissue coverage together with maintenance of limb alignment and joint congruency restoration in cases of severe comminution are the major challenges (19).

Irrespective of resource distribution and details in incident management, the multidisciplinary work before, during and after a terrorist attack needs to be practiced in order to synchronize the abilities and identify the limitation of each involved group. Knowledge of basic terror medicine, communication and information sharing, collaboration and coordination should all be exercised and trained and psychological follow-up of both victims and staff must be carefully planned.

Conclusion

Terrorist attacks are becoming more sophisticated and malicious in the 21st century. New modalities of attacks including the use of unmanned aerial vehicles (UAV)s or drones have become more prevalent. UAVs can be weaponized for use by terrorists, leading to mounting and credible concerns that this attack methodology will be the next terrorism modus operandi (20). Counter Terrorism Medicine (CTM) responders will need to consider how UAVs alter or create new mass casualty scenarios that can further exploit existing medical preparedness and disaster response vulnerabilities.

The increasing sophistication of cyberattacks should also be considered a serious terrorist threat to critical and vulnerable infrastructure such as hospitals (21-24). Additionally, water infrastructure, such as dams and water treatment plants, have become targets of cyberterrorists with the intent of remotely accessing and taking over the controls of a water treatment facility and altering the rate in which chemicals are released into the water, effectively poisoning the water supply (23).

Take-Home Messages

- Terrorists are using ingenious and sophisticated tactics and modalities to create panic and fear. Responders and policy makers must update and adapt their plans and responses tactics accordingly.
- Multidisciplinary approaches to terrorism incidents are needed to address innovative terrorist modalities, such as the use of UAVs and cyberattacks.
- The COVID-19 pandemic exposed the vulnerabilities of healthcare systems globally to physical terrorist attacks on infrastructure such as hospitals as well as electronic systems.

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Chapter 25

EVACUATION OF DISASTER VICTIMS

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Summary

In major incidents/disasters, victims should be evacuated to safe places. A successful evacuation process depends on many parameters, which must be included in a thorough disaster plan. Such a plan is based on risk and vulnerability analyses and identifies appropriate measures for multidisciplinary management of an evacuation. The aim of this chapter is to discuss the various type of evacuation and the importance of planning for such evacuation, particularly in the case of a medical evacuation from a medical facility.

Introduction

Emergency evacuation refers to the process of moving a number of victims/people from one place to another during difficult and pressing circumstances (1-2). Evacuations can occur outdoors, on the scene of a large incident, indoors during a mass gathering, or in large high-populated buildings, such as hospitals, train stations or airports. Each emergency evacuation has its own characteristics and requires a different management approach depending upon the following:

The cause of the incident. Although the aftermaths of a disaster caused by nature or man-made, often vary only very slightly; there are injuries, sufferings and damages that are specific to the cause of the incident (3-5). This is especially true with regard to the risk of further events and the provided information regarding the impacts of etiology on resource management and reallocation possibilities (6-7)

The complexity of the incident. The level of complexity of an incident, i.e. whether the infrastructure is intact or there are severe disturbances, with destroyed surroundings, is crucial in determining the correct management approach. A complex incident will have a considerable impact on logistic and resource distribution compared to more simple incidents (8-9).

The duration of the incident. Is the incident slow and progressing or it is intense and quick? During a slow, developing incident, there is time to think, plan and organize the management operation. While a quick onset incident requires all necessary instruments, such as plans, staff, resources etc. to be in place. Generally, an incident with a quick onset is more chaotic, requiring individuals to take decisions that are more independent.

The location of the incident. It is important, at least from a healthcare perspective, to know whether we are adding new patients to another waiting hospital with intact resources, or if we are moving already sick and non-ambulatory patients in need of intensive care to already overwhelmed hospitals. In the former, the organization must be active in resource distribution, yet the victims should be triaged and evaluated with regard to the needs for treatment and care (10-13). In the latter, however, a functioning hospital with planned operations and full intensive care patients will be moved to another hospital, resulting in further incrimination (14-16).

With regard to hospital evacuation, in general, two scenarios can be anticipated: an immediate evacuation (hospital fire, bomb threat, etc.) or a situation with variable time to plan the evacuation (flooding, hurricanes, etc.) (14-15). Both conditions require a functioning hospital evacuation plan, where responsibilities between different collaborating agencies have been clearly defined. A hospital evacuation is a very complex operation, including the provision of necessary medical care and monitoring during the evacuation, transfer of medical records, and allocation of patients to alternate medical facilities or temporary shelters as well as coordination of different modes of transport including intra-hospital and inter-hospital transfers (16-20). The process may be complicated further by the breakdown of hospital and/or societal infrastructure (power, roads, and communications). Ethical dilemmas and legal issues can be anticipated (21).

Type of evacuation. There can be different types of evacuation depending upon the cause of an incident. In the event of, for example chemical and biological events, it may be necessary and safer to evacuate the area or building (22). Even during an indoors fire, staying in the building while being isolated by fire resistance walls, may be a safer option. Victims may be moved vertically or horizontally to a safer place (20). Total evacuation in contrast, due, for example, to flooding, landslide, threats (bomb), etc. may take place by evacuating a building, a campus or an entire city.

Triage (sorting). Sorting the victims is an important and necessary operation in order to prioritize needs and resources. Patient with diverse medical conditions and needs should be moved to the correct recipient using the correct transport measures (23-24). At outdoor events, triaging is conducted at several locations: earlier directly, in the hot zone i.e. the center of the event, later at the patient collecting areas and finally at the ambulance loading zones. Along with moving the victims, the type of triage varies from a simple primary triage to a more complex secondary one. At indoor events, triage can be more difficult as factors, such as crowding and the limitation of the area, building or surroundings, may force first responders to merely evacuate everyone, rather than conducting a primary sorting. In these cases, triage may be conducted in an area outside and in a close proximity to the incident location. A reverse triage should be addressed when hospital internal staff resources and transport modes are not enough or when the time does not allow to move out all patients. In such a scenario, the number of patients and the severity of their medical conditions should be balanced with hospital capacities, resulting in mobilization of ambulatory and feasible cases instead of non-ambulatory and device-dependent patients (25-27). In a disaster or emergency affecting a hospital, sickest people need to be evacuated from one place to another and reverse triage facilitates the patients' prioritization with a specific focus on non-ambulatory versus ambulatory patients to maximize the survival rate. In an external disaster affected area, however, implementing reverse triage might result in early admission of patients with minor injuries and illnesses, thus affecting bed occupancy rate (28).

Logistics. Different scenarios have different transportation needs. At an outdoor event, private and public vehicles will often be used. The need for ambulance transportation will be high and in a disastrous situation, routine instructions or rules may not be valid. In the disco fire in Gothenburg 1998, for example, ambulances transported two victims simultaneously in order to save more lives. In Paris 2015, 256 patients were transported over 300 times; the number of deaths during transportation was only two. The rate of mortality and morbidity is of course not only dependent on the speed of transportation but also the competency in each ambulance (29). Concerning a hospital evacuation, there is a need for planned activity within the hospital. Each patient transported inside or outside hospital needs to be accompanied by staff. Therefore, it is necessary to have a plan regarding resources and the competency needed for transportation. However, in severe situation with limited information flow, there is a risk that the staff moving out with patients may not come straight back to the hospital, which will result in a shortage of staff in the long-term, as demonstrated in the flooding of Bangkok 2011 (14).

Conclusion

The goal of disaster victims' evacuation is to minimize the consequences of injuries and reduce the suffering experienced by affected individuals. The process of evacuation should be established in a planned and calculated manner to guarantee the safety of all involved, including emergency staff and patients. Therefore, the information about the incident, including its cause, complexity, duration, location, type of hazardous material involved, and available recipient hospitals should be shared mandatorily to facilitate the highest performance of evacuation.

Take Home Message

A safe evacuation requires:

- Risk and vulnerability analysis in all units and among all professionals to identify all the risks related to their activities and surrounding.
- Defining preventive measures targeting all risks in a multiagency approach, where different professions may put forth their perspectives regarding specific risks.
- A contingency/disaster management plan based on the identified risk as well as self-capability, including resources.
- Defining a distinct command and control structure.
- Identifying and defining communication methods in a broad perspective; how different professionals contact each other, the way information is communicated internally and externally regarding the ongoing situation.
- Identification and declaration of careful logistics plans.
- Careful planning for patient safety; patient identification, triage, medication issues, the availability of medical files and responsibilities should be discussed and documented.
- Identification and clarification of recipient facilities/hospitals.
- Early involvement of chief coordinating centers to overview resource use and distribution in order to give support to all involved on the local level.

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Chapter 26

BASIC CONSIDERATIONS BEHIND EMERGENCY EVACUATION PLANNING

Maxim A. Dulebenets

Summary

In case of an approaching natural or man-made hazard, the populations of potentially affected areas are often required by government representatives and other relevant agencies to evacuate and travel to safe locations. An emergency evacuation is generally performed as a staged process, where various population groups are encouraged to leave their residential locations and travel to the nearest emergency shelters along the designated evacuation routes during particular time periods. An effective emergency evacuation plan is critical for timely evacuation and minimizing potential risks to human lives that could be imposed by the approaching natural or man-made hazard. This chapter discusses some of the major considerations that have to be taken into account by government representatives and other relevant agencies in order to design a sound evacuation plan as well as the main challenges that are generally faced throughout emergency evacuation planning.

Introduction

Natural hazards (e.g., hurricanes, tsunamis, earthquakes, tornadoes, severe freezes, snow storms) and man-made hazards (e.g., terrorist attacks, explosions, and infrastructure failures) are reported quite often around the world. A total of 980 natural hazards with the overall losses worth \$210 billion were reported in the year of 2020, which is a more than 20% increase in terms of monetary losses when comparing to the year of 2019 (1). As for man-made hazards, the Chernobyl reactor explosion (28 April 1986) remains the costliest man-made hazard. An explosion of the nuclear power plant reactor caused the overall damage of around \$235 billion (2). In case of man-made hazards, it is quite difficult to predict the approximate time of occurrence. On the other hand, the approximate time of occurrence can be fairly accurately estimated for certain types of natural hazards. For example, the U.S. National Hurricane Center of the National Oceanic and Atmospheric Administration (NOAA) can provide an approximate hurricane path forecast for the following 4-5 days and give a (2-3)-day hurricane warning for the areas under the hurricane path (3).

When the impacts of approaching natural or man-made hazard are anticipated to be substantial or even catastrophic, local government representatives and other relevant agencies announce mandatory evacuation orders. The populations residing in potentially affected areas have to leave their property and travel to safe locations (e.g., emergency shelters or other destinations located far enough from the affected areas). The roadways with high capacity are generally designated as evacuation routes, so they can accommodate the evacuating vehicles. Even locations with low population may cause significant traffic loads on the designated evacuation routes, especially if large groups of evacuees are trying to leave the hazardous areas at the same time. Throughout emergency evacuation planning, local government representatives and other relevant agencies have to consider many different aspects (e.g., evacuation objectives, practical constraints, appropriate emergency evacuation planning methods, and other challenges) that are further discussed in the following sections of this chapter.

Evacuation objectives to consider

One of the critical objectives of emergency evacuation planning is to ensure that the evacuees leave the hazardous areas as soon as possible and reach safe locations, i.e. minimize the total evacuation time (4). Another similar objective that is used in emergency evacuation planning and is connected with the total evacuation time minimization is to minimize the total network clearance time. The total network clearance time represents the time between the moment when the first evacuee enters the network represented by evacuation routes and the moment when the last evacuee exits the network. A reduction in the total network

clearance typically leads to a decrease in the total evacuation time. Some other objectives can be also considered by government representatives and other relevant agencies (e.g., maximize the total number of evacuees, minimize the total evacuation distance).

All the aforementioned objectives mostly capture engineering perspectives and do not specifically account for the social aspects that are associated with the emergency evacuation process (e.g., how the emergency evacuation process may affect the psychological state of evacuees). Individuals rushed to evacuate their residential locations, aiming to minimize the total evacuation time, may experience increasing levels of physical and mental demand (4). Moreover, maximization of the total number of evacuees during a given time period can result in congestion at certain evacuation routes, which will further increase the total evacuation time. In the meantime, congestion along certain evacuation routes may result in frustration of evacuees, which may cause unsafe driving maneuvers and, ultimately, result in accidents. Providing a timely response to accidents along evacuation routes can be challenging. Therefore, some of the objectives that are associated with emergency evacuation planning are conflicting in their nature (i.e., improvement in the values of one objective function may worsen the values of other objective functions).

Multi-objective optimization can be very effective in addressing decision problems that have conflicting objectives. However, multi-objective optimization has been applied in emergency evacuation planning by a very limited number of studies (4-7). Nevertheless, it is critical that government representatives and other relevant agencies have a clear understanding of conflicting objectives throughout emergency evacuation planning. Otherwise, the effectiveness of emergency evacuation process may be negatively affected. A sound emergency evacuation plan should be able to compromise the conflicting objectives and directly capture the associated trade-offs between these objectives.

Practical constraints

Throughout emergency evacuation planning, government representatives and other relevant agencies should keep in mind certain practical constraints. In particular, the capacity of the available emergency shelters is limited. Hence, evacuating individuals have to be assigned to the available emergency shelters in a way that the existing capacity of shelters will not be exceeded. Furthermore, some evacuees may have disabilities and cannot be assigned to general emergency shelters. Evacuees with disabilities are generally assigned to special needs shelters that have appropriate accommodations to serve these evacuees (4). However, the number and capacity of special needs shelters are much lower when comparing to general emergency shelters. Along with the capacity of the available emergency shelters, local government representatives and other relevant agencies should consider the capacity limits for the designated evacuation routes. Evacuating the entire population of a given hazardous area at the same time may create congestion along evacuation routes and delay the entire emergency evacuation process. Evacuating separate groups of the entire population during consecutive time periods in the considered planning horizon (i.e., “staged” evacuation) is one of the viable alternatives that can facilitate a more effective utilization of the available evacuation routes.

Socio-demographic characteristics of the evacuating population (e.g., gender, age, driving ability, emergency evacuation experience, health status, racial group) may substantially influence the emergency evacuation process (8-10). Driving ability of individuals typically declines with age due to changes in sensory functions, cognition, physical functions, vision, hearing, as well as medical conditions (11-13). Presence of chronic diseases that are often observed in aging adults (e.g., heart diseases, Parkinson’s disease, Alzheimer’s disease, diabetes, arthritis, and dementia) negatively influences their driving ability and may result in crash occurrence (14-16).

The impacts of cognitive changes and perceptual changes may intensify for vulnerable population groups under emergency evacuation conditions. Therefore, special considerations are needed for emergency evacuation planning in the locations that have a high proportion of aging adults and other vulnerable population groups (e.g., assign higher priority and allow vulnerable population groups evacuating first).

Emergency evacuation planning methods

A basic emergency evacuation planning problem, which aims to assign evacuees of a given location to travel along certain evacuation routes to some of the available emergency shelters that have a sufficient capacity, can be formulated as a mixed integer programming model (17). The main challenge of solving basic emergency evacuation planning problems stems not from the computational complexity of the model itself but from the size of input data (as many large-scale emergency evacuations involve hundreds of thousands of evacuees). The exact optimization methods for mixed integer programming models (such as GUROBI, MOSEK, CPLEX) may return memory errors when executed for large-size instances of the emergency evacuation planning problem (17). Furthermore, consideration of additional practical aspects (e.g., modeling several objective functions, capturing additional practical constraints within a model, and accounting for certain evacuation requirements) may increase computational complexity of the mixed integer programming model for the emergency evacuation planning problem. The model itself may even become non-linear, as social aspects of evacuees (e.g., mental demand, physical demand, and frustration) throughout the emergency evacuation process are generally described with complex functions that may be non-linear (10).

Therefore, advanced solution approaches are required to effectively tackle large-size instances of the emergency evacuation planning problem, including heuristic and meta-heuristic solution methods. Both heuristic and meta-heuristic solution methods can provide good-quality solutions for challenging decision problem within a reasonable amount of computational time (17, 18). Heuristics generally consider particular properties of a given decision problem (i.e., they are problem-specific solution methods). On the contrary, meta-heuristics (such as Artificial Bee Colony, Generic Algorithm, Genetic Programming, Firefly Algorithm, Krill Herd Algorithm, Virus Colony Search, and Variable Neighborhood Search) are recognized as a broader group of solution methods that can address a wide variety of decision problems. One of the main reasons for using heuristic and meta-heuristic solution methods to address the emergency evacuation planning problem is the computational time aspect. Timely decisions are critical in case of an approaching natural or man-made hazard, so that the potentially affected populations can safely vacate the hazardous locations.

Existing challenges

In summary, some of the major challenges that are generally faced by local government representatives and other relevant agencies throughout emergency evacuation planning include, but are not limited to, the following:

- Although there are some ***forecasting tools*** that can be used for estimating the approximate time of a hazard occurrence in particular areas (e.g., the NOAA hurricane track forecasting tool), more efforts and research are needed towards the development of more robust methodologies. Such methodologies should provide an accurate forecasting for different types of hazards, so potential affected populations would have sufficient time to safely evacuate the locations to be affected.
- One of significant challenges in emergency evacuation planning is ***compliance with evacuation orders***. Many residents refuse to leave their property even after evacuation orders have been announced by local government representatives and other relevant agencies (19-21). Additional strategies should be introduced by local government representatives to increase compliance rates with evacuation orders and make the entire emergency evacuation process more organized and cohesive.
- When allocating the available capacity of emergency shelters, there may be some challenges that are associated with ***“shadow evacuation”***. Shadow evacuation refers to the situation when people evacuate their residential locations even if they were not requested by local government representatives and other relevant agencies to do so. Shadow evacuation may cause issues not only with the allocation of emergency shelters but also may create congestion along the available evacuation routes. Innovative methods should be developed in future to forecast the expected increase in the number of evacuees due to shadow evacuation.

- A significant amount of research efforts have been undertaken aiming to understand the impacts of socio-demographic characteristics of individuals on their driving ability (10). However, only a limited number of studies investigated how *socio-demographic characteristics* of individuals may influence their driving performance throughout the emergency evacuation process. Additional studies should be administered in this area, so the outcomes could be used by local government representatives and other relevant agencies to make adequate accommodations for vulnerable population groups.
- Although some of the previous studies developed planning tools and *methods for the emergency evacuation planning problem*, more dedicated and comprehensive research efforts are still needed in this direction. In particular, the future studies should focus on the development of robust mathematical models and solution methods that capture the main realistic features of emergency evacuation (e.g., consideration of conflicting objectives, modeling behavior of evacuees along evacuation routes, capturing specific attributes of vulnerable population groups throughout the emergency evacuation process). These robust mathematical models and solution methods will assist local government representatives and other relevant agencies with more effective emergency evacuation planning. Without such planning tools, it will be difficult to develop a sound emergency evacuation plan in a timely manner.

Conclusion

The populations of potentially affected areas are often required by government representatives and other relevant agencies to evacuate and travel to safe locations in case of an approaching natural or man-made hazard. This chapter provided a concise discussion regarding of the major considerations that have to be taken into account by government representatives and other relevant agencies in order to design a sound evacuation plan (i.e., evacuation objectives, practical constraints, appropriate emergency evacuation planning methods, and other challenges). It can be concluded that emergency evacuation planning is a complex task and has to be carefully approached by government representatives and other relevant agencies to ensure population safety and timely response to the approaching natural or man-made hazard.

Take-Home Messages

A sound evacuation plan should account for the following important aspects:

- Some objectives of emergency evacuation planning may be conflicting in nature (e.g., individuals rushed to evacuate their residential locations, aiming to minimize the total evacuation time, may experience increasing levels of physical and mental demand).
- The emergency evacuation planning problem is a multi-objective optimization problem. There is a need to compromise the conflicting objectives throughout emergency evacuation planning and directly capture the associated trade-offs between these objectives.
- A variety of practical constraints should be considered (e.g., capacity of the available emergency shelters, capacity of the designated evacuation routes, impacts of socio-demographic characteristics of the evacuating population).
- Advanced solution approaches, such as heuristic and meta-heuristic solution methods, are required to effectively tackle large-size instances of the emergency evacuation planning problem (generate good-quality evacuation plans within a reasonable amount of computational time).

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Chapter 27

PANDEMICS

Roberto Faccincani

Summary

Infectious diseases are not last-centuries problems: they are still the leading cause of death in children and young adults in low-income countries, but also a real hazard globally, as the recent COVID-19 pandemic has dramatically demonstrated. Although there is a high probability for emergence of pandemics, little is offered for their management. Consequently, constant monitoring and early warning systems of outbreaks, restrictive measures, social distancing, use of PPE and hand washing together with vaccination are the best “weapons” to fight against pandemics. While fighting a pandemic, attention should be paid to non-pandemic patients, to avoid the indirect damage and the increase in mortality and morbidity of medical conditions that commonly have better outcome if treated timely but are simply left behind because of the major focus on the pandemic victims.

Introduction

COVID-19 outbreak in 2020 has dramatically rekindled the interest on infectious diseases. While in high-income countries, they were deemed defeated, infectious diseases have been the focus in low-income countries, remaining the deadliest in children and young adults, according to the WHO data (1). In today's global society, infectious disease outbreaks can spread quickly across the world, fueled by the rapidity with which we travel across borders and continents (2).

Definition

Infectious diseases are caused by “live agents,” such as parasites, bacteria, fungus or viruses, who are able to pass from a guest to another and in this sense are defined contagious. There are agents that affect only one species of the animal kingdom (including humans), and others that can pass from one species to another. When there is a transmission from an (other) animal to man, this is called a zoonosis. During this transfer from species to species, the agent can change its characteristics, thus, a harmless animal virus can become very lethal in humans. There are agents who are commonly present in the human body, inoffensive or even useful (saprophytes) but can become dangerous under particular conditions (for example the intestinal bacteria flora). Other organisms are always harmful (pathogens), although the infection has to win against the immunity system to lead to a proper disease. In this sense, the medical science refers to vaccination as the practice of exposing an individual to a pathogenic attenuated agent or part of it, to train the immunity system to recognize the condition and to become capable to control it, avoiding the development of a proper disease.

Some pathogens appear suddenly out of nowhere; others are ever-present in society. Usually infected cases are present in numbers below an expected threshold, but every once in a while there may be an outbreak, a new strain or a new disease that has a significant impact at either a local or global level. The spread and rate of new cases can be classified as:

1. Endemic: a disease that is permanently present in a region or population
2. Epidemic: an outbreak that affects many people at one time and can spread through one or several communities
3. Pandemic: it is an epidemic that spreads globally (3)

Why infectious diseases are relevant for this handbook?

With the recent outbreak of the Sars-CoV-2 pandemic, heavily hitting completely unprepared nations globally, despite earlier warnings about a possible scenario, this question seems futile (4-5). The reality is that until now, the risk perception regarding a pandemic has been very low in high-income countries, linking the risk of an infectious disease outbreak related to poverty, poor hygiene and sanitation, and low level of education; definitively all conditions confined to the low-income countries. With COVID-19 pandemic proving global underestimation of the risks, there is a window of opportunity to take advantage of the errors, exploring the scenario of an outbreak with the instruments of the disaster management cycle (5-7).

Prevention

It is probably impossible to eliminate the risk of an infectious disease outbreak since as long as parasites, bacteria, fungus and viruses exist, the risk will never diminish. These organisms have been present on the Earth long before humanity and can survive without humans, while we cannot live without them. They are somehow necessary for survival of the human species (think again to the intestinal bacterial flora). However, if we cannot eliminate all potentially harmful agents, we may be able to reduce the risk of usually non-harmful microorganisms to become harmful and pathogenic by one of the following options (4-5, 8):

- To prevent the agents to pass from one species to another, as in this transit they often acquire capacity to harm. In this sense, we have to avoid animal-human contiguity and practices of eating wild animals' meat, in particular if not well cooked.
- Another way the pathogens can mutate becoming more harmful is if they spread too fast: in this sense also restrictive measures (more substantially considered part of the mitigation phase) have a role in prevention; as soon as an outbreak has been reported, all the measures to limit the spread should be considered.
- Vaccination is probably the most important preventive measure. It reduces not only the risk of an individual to be contaminated by coming in contact with a pathogen (mitigation) but also to get a disease at all (prevention). According to the public health concepts, massive vaccination in a community reduces the circulation of the agent, up to the limit of its cancellation (herd immunity). A well-cited example is the eradication of polio, thanks to the global massive vaccination campaign (2, 8).

Public education, hygiene and sanitation measures, increase in wealth and access to health are not only mitigation measures but also preventive against infectious diseases. It is thus evident how the low-income countries are more prone to outbreaks as well as to more devastating effects of diseases that in rich countries are far from being a problem (for example cholera or measles) (9).

Disaster cycle and pandemic

Preparedness/Mitigation: Preparedness aims at becoming prepared for what has yet to come. Risk assessment, contingency planning, training and other educational initiatives, must be part of preparedness. Mitigation is the capacity to reduce the effect of an event. In case of an infectious disease outbreak, the most important action to reduce the consequences of this event is to avoid an epidemic to become a pandemic. As earlier mentioned, restrictive measures, up to the strict lock-down in the outbreak site, are the most important actions to limit the spread. It is interesting to recognize how the epidemics “travel” using the infrastructure of a society, and following the people travel routes. Similar to the plague in the past, following the sea routes or the movements of the armies, and like seasonal flu, following the air routes, and the COVID-19 pandemic (2, 8, 10).

The need of implementing fast and strict restrictive measures to limit the spread of an outbreak highlights the essential role of an established early warning as well as constant monitoring systems of infectious diseases

worldwide. These systems are active, more or less punctual in the different regions and are usually maintained by the WHO in collaboration with the national health authorities. Inside the community, the spread of the contagion can be reduced by the use of PPE, social distancing and hand washing: all these measures have become nowadays very well-known because of the the COVID-19 pandemic. Isolation of the affected and use of PPE are measures always in place to prevent contagion in the health sector (2, 810).

Response: Responding to an infectious disease outbreak indicate the actions that should be taken to reduce the mortality and morbidity of an ongoing event. Restrictive measures, such as extensive use of PPE, social distancing, hygiene and sanitation practices, vaccination campaigns, can also be considered as part of the response, while provision of treatment to those affected is more adequately the focus of the response. As the COVID-19 pandemic has shown, the response should of course relate to the type of event (e.g., acute respiratory syndrome caused by a corona virus, with the specific need of testing and tracing, providing medical assistance to patients in respiratory distress with thromboembolic complications, supplementary oxygen supply, non-invasive and invasive ventilation devices). However, it should also be recognized that an all hazard approach including, the principle of preparedness, centrality of logistics, need of clear communication and command chain and all the other rules of the crisis management are crucial in handling a pandemic. It is important to recognize that these activities are the responsibility of the health care system (public or hospital) and all entities have to mobilize their abilities and resources during an outbreak, in all phases of disaster cycle (2).

Recovery: As soon as the epidemic situation allows, the system should go back to the standard operations: in case of the health system the resumption of the non-emergency related activities is of utmost importance to avoid the indirect damage of the event: the loss of patients “abandoned” while the system was engaged with the care of the “disaster patients”. Actually, this risk is well known and reported in every disaster, in particular in case of epidemics, when patients avoid reporting to hospitals because of the fear of getting infected (5-7). A clear increase of deaths for stroke and myocardial infarction has also been described during the COVID-19 pandemic. It is important to underline that the care of the time-dependent medical conditions (trauma, stroke, myocardial infarction) should be guaranteed also during the pick of the emergency. The health system should find alternative ways to keep the standard of care for these conditions despite the effort for the emergency. During the COVID-19 outbreak, Lombardy experimented a regional health model where few centers were recognized as hub for the time-dependent ordinary medical conditions, while other for the COVID-19 patients. Despite this, an ongoing national investigation is to evaluate why one of the richest regions, granted with one of the most advanced global health systems performed so badly (10).

Re-evaluation: The re-evaluation of an event is always the presupposition to learn from the experience, avoiding to make the same errors and to improve the future performance. This became extremely evident during the COVID-19 pandemic, when the world experienced successive waves of epidemic pick.

Conclusions

Pandemics are very probable disaster scenarios. The recent COVID-19 outbreak has dramatically demonstrated how the world has unconsciously underestimated the risk of pandemics and has been found completely unprepared to face this challenge. The principle of the disaster management cycle (prevention, preparedness/mitigation, response, recovery and re-evaluation) can guide the process of fighting pandemics. Mitigation in terms of implementation of quick and strict restrictive measures, use of PPE, social distancing, hygiene and sanitation guidelines, are the most important weapons in the hands of the society when an outbreak has emerged, while vaccination and other preventive measures should be implemented as soon as possible. Response has proven to be often inadequate even in the richest regions and by the most advanced health systems. When allocating resources in regard to risk and vulnerability reduction programs against

disasters, authorities should take into serious consideration infectious diseases outbreaks, epidemics and pandemics.

Take-Home Messages

- Pandemic should be a part of disaster and emergency management plan at local, national and international level.
- The initial management of pandemic in the absence of vaccine and direct medical treatment is the implementation of public health strategies, such as quarantine, social distancing, and the use of personal protective equipment (PPE).
- Appropriate program should be offered to the public and professionals to increase the management compliance.

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Chapter 28

RECOVERY AND RECONSTRUCTION

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Summary

Recovery and reconstruction (RR) is a dynamic process with an early relief component and a long-term reconstructive one. It needs a flexible strategy based on continuous feedback and needs assessment. Corrective measures must be established according to priorities using a holistic approach. Local, national and international cooperation when needed must follow the same targets, respecting the local and national characteristics, harmonizing them in order to endorse the recovery plan. Effective communication in order to mitigate the damage and assist recovery during the same time and a flexible, adaptive attitude must guide the RR actions.

The objective of RR management is to provide effective and efficient coordination and delivery of programs and services to assist and hasten the recovery of affected communities as well as involving organizations. Recovery management embraces the measures taken before, during and subsequent to any event. The information on recovery management is intended for all personnel involved in emergency management, not only recovery workers and managers. It is necessary for all involved in emergency management to have knowledge of recovery management functions to achieve the necessary coordination between agencies, services, workers, and managers. This chapter aims to give a notion on the program and the method of promoting a quick and effective recovery and reconstruction after a major incident.

Introduction

Development is a dynamic process, and disasters are the opportunities to vitalize and/or revitalize this process, especially to generate local economies, and to upgrade livelihood and living conditions. This is especially relevant in the context of developing nations. Post-disaster reconstruction and rehabilitation is a complex issue with several dimensions. The government, non-government, and international organizations have their own stakes in disaster recovery programs, and links must be established among them, as well as with the community (1-3). In other words, post-disaster rehabilitation and recovery programs should be seen as opportunities to work with communities and serve local needs. Moreover, community social capital involvement has been implemented to improve individual functions and mental health (4-6). One problem to overcome is that relief and development often lead to burdens on the recipient government, and often fail to serve the actual purpose and to reach the people in need. RR is included in the post-disaster phase, containing all the actions initiated as a response to a disaster, aiming for early recovery of the affected communities.

Although it starts immediately after the disaster, it contains several measures which can be found in all phases of the disaster management cycle, such as coordination and on-going assistance. Different approaches have been established, but the main steps of the post-disaster response can be summarized as follows (7):

- Disaster relief includes all the means to provide immediate shelters, life support and basic needs of those individuals (physical, psychological and economy) affected by the disaster or involved in disaster response (8).

Disaster recovery is a coordinated process of supporting the affected communities in their effort of reconstructing infrastructure, economy, and environment taking into consideration the locality's cultural practices and social traditions and issues including the recovery of all emergency services. Regardless the type of the disaster, RR has three main phases: *planning, implementation and post-implementation analysis*. Each phase takes place at different levels through several processes. It must be emphasized that during these phases, assessing the relationship between needs and outcomes must be a continuous process,

which assures the success of the entire process. Consequently, RR must be understood as a dynamic process, which demands a huge capacity for adapting tasks to the field situation, requiring a complex view of material and human resources, as well as an integrated multi-organizational approach.

RR planning Phase

This phase includes the following elements; Assessment, Establishing an action plan, and Validating and financing the plan.

- a. **Assessment** is focused on identifying the key outcomes necessary and sufficient to keep the RR process working. A major factor in performing this assessment is the available time, as a full assessment of the socio-economic situation and access to the services may not be possible sometimes when the situation is changing fast, no matter the amount of time available. Several aspects must be covered by this assessment, namely:
 - The causes and the characteristics of the disaster.
 - The extent of the consequences of the major incident (MI) (short-term, intermediate-term, and long-term consequences to population, societies, and emergency services) (9-10).
 - Risk analysis, including natural, economic, social, security etc. risks, as well as their trends (predictably up, predictably down or unpredictable)
 - Emergency service capacities and capabilities; the prolongation of MI results in the exhaustion of workers and systems, and routine works are underserved and cumulated overtime (11-13).

The assessment must cover all the domains affected by the MI and must be performed by teams established based on priority settings and not sole individuals. Elaborating a dynamic map of risks would be of high benefit as it is a useful tool in guiding the resources as well as to avoid useless human and material efforts, and the parameters for selecting the participants involved in RR.

b. Establishing an action plan is a complex process, which should be based on the assessment and allotted resources (available resources and necessary resources) and three questions must be considered:

- **What resources must be used, by whom and when?** The difference between available resources and necessary resources must be considered in terms of *where from* and *how fast* needed but missing resources can become available (and if this time does not exceed a limit of usefulness) (8, 14-15).
- **What are the expected outcomes?** It is mandatory that identifying expectations should be realistic since complete one-step recovery of any type of damage following an MI is unlikely. When establishing the outcomes, quantitative landmarks are usually used and these should be considered as flexible intervals rather than fixed values since multiple factors can interfere with the recovery process; therefore, the outcomes must be designed considering all these potential negative (rarely positive) influences.
- **What are the regulatory mechanisms: feedback from the field, coordinating structures, and monitoring activities?** Planning the regulatory mechanism is crucial for RR, due to the high variability of the post-disaster situation. Such regulation must at least include answering the following two questions: a) Have the human and material damages reached their final state after the disaster, i.e., do the MI not evolve at all when it once finished? b) Is there any persisting factor, which complicates the initial damages or leads to new ones? This situation is encountered more frequently than the final state situation. Moreover, it can generate a “cascade” of damaging factors, which must be addressed. The regulatory mechanism must include:
 - o *Recording the sources of information and the channels to get information on the field.* The type of information and the timing of its delivery depends on the nature of the disaster, as well as on the communication possibilities. Field operations must be informed about the actions initiated by the center to thoroughly monitor them and report action outcomes to the center.

- *A central coordinating agency, which analyses the information, must include specialists from key domains related to the nature of disaster, as well as resource providers.* The purpose of this analysis is to establish whether the corrective actions have attained their milestones or not. If not, necessary supplementary measures would need to be employed to support the corrective action. Successful actions must be continued, remaining resources must be identified and further needs must be established. Providers of further resources, as well as how these resources will become available must also be described. The coordinating agency (national or international) must provide directions and standards to the field teams, ensure that linkage and communication between different sectors at the same level, and between levels are efficient and known.
- *The result of this analysis is delivered to the field coordinating structure, which is responsible for implementing the proposed measures.* For each measure, it is advisable that it should be monitored continuously, not only at the end of the task, since late detection of any imbalance between the expected pathway and the actual situation might result in an impaired outcome, which is different from what was proposed and often inferior. Once the regulatory mechanism is established, it is important for its continuity to be assured as any gap might result in a severe disruption of the entire process.

Moreover, the cascade of damage constrains daily response systems of departments that provide emergency response services like police department, firefighter department and hospitals because the services maximize their capacities to satisfy injuries, suffering, and safety from MI. The concurrent and anticipative occurrences must be properly rescheduled, remediated, or some of them must be resumed (16). Guidelines are developed to facilitate services prioritization such as, for hospitals, the time-sensitive elective procedures scoring system was created (17-18). However, each country or affected area has different contributing factors with distinctive ethical aspects. The collaboration in health care institutes and other parties will harmonize the alignment.

c. Financing the action plan does not only involve (as it might seem) the economic and financial mechanisms, but the team as a whole, since the careful assessment of each step must be performed during this process, too (19). As precise financial evaluations are difficult to be achieved during the immediate post-disaster situation, which changes continuously, multidisciplinary cooperation is mandatory in order to avoid confusing situations. Therefore, a feedback regulatory mechanism, which ensures the dynamic character of the financing activity, is crucial for the success of RR.

Implementation Phase of the RR plan

This phase continues the planning action but it is not temporally separated from it, since planning does not stop when the plan is implemented in the field. Moreover, since a rapid action is needed in most cases, the time between the two phases is very short, so practically they co-exist after a very short interval until the first practical measures are taken. Implementing the RR plan requires the combined action of organizations and structures in all fields affected directly or indirectly by the MI (Major Incident). It is important that the feedback and regulatory mechanisms work properly, as most of the implementing actions need adjustments due to the evolving character of the situation.

Regardless of the domain and the level of their activity, all the structures involved in implementing the RR plan must have enough information to adapt to any unusual situation within the limits of the plan. Therefore, the coordination of debriefing the field personnel by the central structures must be carefully performed so as not to jeopardize their ability to respect the plan, while actively involving them in correcting potential inconsistencies of the plan detected in the field. The RR plan, aside from these aspects mainly specific to the relief phase, involves complex measures addressing all aspects of socio-economic life, regional and national specific features, and regional implications (20). Particular attention must be paid to cross-cutting issues within the country-specific context since a tailored solution needs to be applied in these situations. The teams

involved in RR should, therefore, contain persons familiar with cross-cutting national issues, who are able to harmoniously integrate them into the RR structure. The municipal and central government correspond with the implementation to sustain the plan and long-term recovery (21).

The Post-Implementation Analysis Phase

This phase is an ongoing process with a short-term post-relief phase and a long-term one centered on reconstruction. The same aspect of continuity is crucial since this analysis takes place immediately the plan is operational and, therefore, several multidisciplinary teams must monitor different stages of the post-implementation period to maximize the efficacy of the efforts and establish useful knowledge for future critical situations. Both positive and negative aspects must be studied, identifying what went well and what went wrong, to transform the current situation into a valuable source for future training and avoid future failure (21-22). The main work in the recovery process depends on individual and organizational competency in identifying, addressing, and evaluating social, psychosocial, and environmental impacts of public health emergencies and disasters, including bioterrorism events and threats. Key aspects of this competency expectation include:

- Describing the major phases of an emergency event and disaster recovery, and various stages within each phase.
- Describing the prioritization process of recovery and factors affecting the establishment of these priorities.
- Identifying key participants in the recovery process and their roles.
- Describing how an evaluation of the medical, public health and public service responses to emergencies and disaster can be designed and carried out.
- Describing approaches and tools for data collection under emergency conditions.
- Describing how evaluation data can be used to improve emergency preparedness and response.
- Describing the concept of multiple barriers and the effects of crises on various barriers.
- Describing specific disease transmission processes interrupted by major environmental interventions and selecting priorities to adapt to individual circumstances.
- Describing important social and psychosocial effects of emergencies and disasters and the groups at highest risk.
- Discussing strategies for preventing and mitigating social and psychosocial impacts.

Conclusion

Successful recovery and reconstruction depend on an extension of information retrieval, initial assessment and a resilience of communities' responses. Many countries implemented The Sendai Framework for Disaster Risk Reduction 2015-2030 and the United Nations' Sustainable Development Goal to the disaster incident and recovery preparedness. However, the local and central governances play major roles in community resilience results in policies and programs creation and implementation. These collaborations create the sustainability of recovery and reconstruction.

Take-Home Messages

Recovery and reconstruction are dynamic processes of assessment, scheme, management, and evaluation. The long-term consequences are disasters and emergencies, such as physical, psychological and economic issues, should be identified and carefully handled. These processes could be smoothly implemented by a collaboration among central government, municipal organization, and inhabitants.

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Chapter 29

PHARMACEUTICAL NEEDS AND STORAGE IN DISASTER

Binaya Sapkota

Summary

Disaster medicine is the multidisciplinary and collaborative study covering various health disciplines. Pharmaceutical products are one of the major necessities pre-, peri- and post-disasters and disaster formulary can better address the needs of disaster medicines to be stocked at hospital pharmacies, community pharmacies and other disaster sites. Pharmaceuticals' shortages can adversely affect medication therapy, lead to medication errors, compromise medical procedures and cause health hazards. Therefore, mechanism of stringent inventory management need to be implemented to tackle the negative impact of disasters although exact needs can be difficult to predict prior to the incidents due to the disproportionate effects of disasters every time. The aim of this chapter is to describe the requirements of pharmaceutical products and their inventory management during disasters.

Introduction

Disaster management cycle and pharmaceutical needs

A disaster management cycle can be classified into different phases (see chapter one) (1), and pharmaceutical products are needed at each phase and are the cornerstone of therapy for the injured and psychologically agitated people at the time of disasters. Oral dosage forms of medicines and some dressing sets can be arranged at household levels and disaster sites to tackle with the early phases of disaster, while oral as well as injectable medicines and surgical items are necessary at health care facilities (HCFs) to tackle with rest of the phases-emergency relief, rehabilitation and reconstruction phases.

Post-disaster complications (PDCs) and management

Disasters-induced wounds are the most prominent physical hazards, and as the topical antibiotics are not much effective to reduce the infection rates, systemic antibiotics are preferred. Single doses of penicillin (in case of mild contamination) to longer durations can be used as the prophylactic regimen to minimize wound infections in hands and feet. Prophylaxis with the broad-spectrum antibiotics often decreases infection rates and promotes wound healing. Great caution is necessary due to the burgeoning cases of antibiotic resistance to the commonly used antimicrobials such as amoxiclavulanate, ceftriaxone, cloxacillin and other (2).

Disaster medicine

Disaster medicine is a multidisciplinary and collaborative study covering various health disciplines (e.g., epidemiology, public health, etc.) for the prevention, response and rehabilitation of disaster health problems (3). According to the Inverse Response Law, people in lower socio-economic groups are more affected and experience more disparities in service during disaster response and recovery (4-5). Therefore, sound pharmaceutical logistics should be arranged at all levels of pharmaceutical supply chains, such as manufacturers of raw materials and finished products, superstockists/stockists/wholesalers/distributors, healthcare facilities (HCFs), and the end users (e.g., patients) (6).

Disaster formulary

Disaster formulary should include essential medicines for treating major and common chronic diseases such as diabetes mellitus, hypertension, asthma and post-traumatic stress disorder (PTSD); and acute care medications (e.g., anti-inflammatory drugs, antimicrobials). Medicines with multiple indications (e.g., ibuprofen) are good to be included and other can be supplemented according to the nature and severity of disasters (7).

Table 1: An example of a representative list of disaster medicines

Substances	Examples
Acetaminophen and non-steroidal anti-inflammatory drugs (NSAIDs)	Diclofenac, Ibuprofen
Antianginals	Isosorbide dinitrate, Glyceryl trinitrate sublingual tab.
Antianxiety drugs	Benzodiazepines (Lorazepam, Midazolam)
Antiarrhythmic	Lignocaine inj., Digoxin tab.
Antibiotics	Amoxicillin cap., Ceftriaxone inj., Metronidazole inj. and tab., Doxycycline cap., Ciprofloxacin tab.
Anticoagulants	Heparin inj., Warfarin tab.
Anticholinergics	Atropine inj., Ipratropium bromide nebulizer (8-10)
Antidiabetics	Insulin inj.
Antiepileptic	Phenytoin inj. and tab.
Antihistaminic	Diphenhydramine, Promethazine inj
Antihypertensive	Atenolol, Labetalol inj., Nifedipine
Antinausea and antidiarrheal medications	Oral rehydration salts (ORS) (11)
Antiplatelet	Aspirin (low dose)
Antipsychotics (oral and inj.)	Haloperidol
Antiseptics	Povidone iodine, Sanitizers
Bronchodilators	Salbutamol nebulizer
Corticosteroids	Hydrocortisone inj., Prednisone tab.
Diuretics	Furosemide
Equipment	Disposable blood pressure cuffs and sphygmomanometer, Thermometer, Sharp containers, Pulse oximeter
Inotropic agents	Adrenaline inj., Dopamine inj.
Intravenous fluids	Normal saline, Ringer's lactate, Dextrose, Dextrose with normal saline, Sterile water for injection (SWFI) (12)
Magnesium sulphate inj.	-
Methylxanthines	Aminophylline inj.
Muscle relaxants	Vecuronium inj.
Opioids (oral and injectable)	Morphine, Tramadol, Fentanyl inj.
Plasma volume expanders	-
Sodium bicarbonate inj.	-
Surgical items:	Sterile gloves; Dressing, adhesive, impregnated and elastic bandage; Arm slings, Cervical collars, Knee and wrist immobilizers, Central vein catheter, Foley catheter, Skin stapler, Plaster of Paris/Scotch cast, personal protective equipment (PPE) set, Oxygen masks and cylinder with oxygen (13)
Syrings	3 mL, 10 mL, 50 mL, Insulin syringe
Vaccines	Tetanus booster dose, Oral cholera vaccine
Water purifiers	Chlorine tab. and solution

Criteria for selecting a therapeutic regimen in the formulary can be expressed with the following equation: (7)

$$\text{Value of a regimen} = \text{Benefit of the regimen} + \text{Danger of not treating the condition} - \text{Adverse events}$$

Some of the representative list of disaster medicines that are relevant for disaster formulary can be tabulated as in Table 1. The injectable dosage forms are useful especially for the hospital logistics whereas the oral forms can be applicable even at the community pharmacy and disaster sites.

Pharmaceutical storage and inventory management practice during disasters

The normally applied ABC (Always Better Control) or VED (vital, essential, desirable) systems of inventory management can be applied even for the stock management during disasters. The former system is applicable especially for the resourceful countries or settings whereas the latter for the resource constraint settings. Safety stocks (SS), maximum stocks (S_{max}) and minimum stocks (S_{min}) should be carefully computed considering the additional requirements of inventory during disasters. The World Health Organization (WHO) has developed simple formulae to compute optimum inventory level for normal periods.

Nevertheless, these simple formulae can also be useful for disasters but we need to be vigilant to keep at least 10 per cent extra inventory while considering the reorder level, compared to the normal periods (14). Perpetual purchasing focusing on the current needs of the pharmaceutical products is also applicable to handle the disasters-induced shortages of pharmaceuticals. Essential products can also be extemporaneously prepared, if their supply is interrupted, if we have arrangements of active pharmaceutical ingredients (APIs), excipients and facilities.

There should also be mechanisms to handle the donated products, if some humanitarian supports are received at the time of disasters. Care must be taken to handle the expired or damaged products during disasters.

All medicines may not be equally needed and have beneficial effects during disasters. For example, during influenza A pandemic in 2006, the Center for Disease Control and Prevention (CDC) advised against the use of amantadine and rimantadine for influenza prophylaxis or treatment, and approved only oseltamivir or zanamivir for the same. Oseltamivir can be used by adults and children at least one year of age whereas zanamivir by adults and children at least five years of age (15).

Post-exposure prophylaxis (PEP) may be required for tetanus depending on the patient's previous immunization history. When immunization history of the patient is unknown, or if he/she received less than three doses of tetanus toxoid, both tetanus toxoid and immunoglobulin should be administered. Second dose of toxoid should be given within next two months, followed by the third dose in the following 6-12 months. If the patient has already completed immunization within five years, tetanus toxoid or immunoglobulin should not be given. If the immunization was completed prior to five years' period before the incumbent injury, a single dose of tetanus toxoid should be administered. Diphtheria, pertussis, tetanus (DPT) vaccines can be administered to the pediatric patients (under seven years of age), instead of tetanus toxoid (2).

Conclusion

During pandemics and other disasters, overall health systems, including hospitals, face diverse challenges related to logistics (e.g., medicines, vaccines, medical devices and other) and human resource management (e.g., health professionals and support personnel). Therefore, hospitals should have preparedness strategies in advance to manage the victims effectively and efficiently (16). For example, challenges faced during the COVID-19 response included health professionals with limited training in emergency preparedness and response (EP&R), lack of sufficient PPE (e.g., face masks, hand sanitizers) and medical supplies (e.g., testing kits, ventilators, hospital beds, supporting treatments, vaccines) (17).

Pharmaceuticals' shortages can adversely affect medication therapy, lead to medication errors, economic burden in care, compromise medical procedures and cause health hazards. Managing pharmaceuticals' shortages is complex for health care practitioners especially in hospitals and acute care settings where patients are regularly treated for acute or emergent conditions. Pharmaceuticals' shortages can be caused by one or more factors throughout the supply chain such as demand fluctuations leading to ill inventory practices, shortages of APIs or excipients, manufacturing delays and quality problems (6).

Take Home Messages

Disaster formulary list and their proper inventory management should be implemented at the time of disasters. Proper purchase control and setting of reorder level keeping at least 10 per cent extra inventory for essential medicines are good practices to handle the disasters-induced pharmaceuticals' shortages.

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Chapter 30

TRAINING AND EXERCISES

Eric Carlström, Amir Khorram-Manesh

Summary

There are three types of exercises: drills, strategic exercises, and collaboration exercises. Drill and strategic exercises have a long history and originate from the military context. Collaboration exercises have been more and more in focus in recent decades. They are difficult to accomplish but crucial for preparedness. Ineffective collaboration exercises merely focus on problem identification repeatedly and do not contribute effectively to the learning. Consequently, developing instructive, appropriate, and effective exercises is the challenge, particularly, if the aim is to enhance preparedness. Learning is particularly effective when professionals learn from each other, through open forums where participants from different organizations come together for discussion. Exercises, which give space for seminars and critiques, can result in new patterns of thoughts. These patterns are useful in actual events since as long as learning is in focus, the participants are keen to expose their own shortcomings, not hide them. With such an openness, the participants admit that mistakes will happen and that an exercise will support them to reveal their weaknesses. Reflexive and self-critical seminars during exercises are as important as the exercises themselves. The aim of this chapter is to give a brief insight in exercises, their origin, aim, and potential outcome. Another aim is to take a critical look on the challenges of managing exercises. Furthermore, it provides the lecturer with a curriculum when teaching basic techniques and theories of exercises.

Introduction

Exercises can be traced back to warfare and the need to make war missions and operations predictable. The oldest and still most used type of exercises is the drill, which is a repetitive performance of a professional skill in a military context to make individuals ready to act synchronous and efficient. The dominating strategy during centuries was command tactics, in contrast to mission tactics, and thus the focus of the drill was on the soldier's ability to understand and follow orders. A nation in the forefront practicing command tactics was Prussia. Morgan (1) reports how Fredrick the 2nd of Prussia (also named Fredrick the Great) as a young boy loved to play with mechanical toys and combing them with a military hierarchy. Later, he built an army where the soldiers were lined up in perfection and obeyed order without doubt. Discipline was established with drill, punishment, and rewards. War techniques, like handling weapons, were repeated to the degree of perfection. The next step, invented by the Prussian army in the beginning of the 19th century, was the Kriegsspiel, a model of strategic exercises to train officers. In a sandbox or on a table tin soldier, cannons and equipment strategic exercises were developed to observe where the effect of different settings was predicted. Hand-to hand combats were compared by using different types of weapons, cavalry, units, and maneuvers (2). Different types of exercises have different aims. Below, three types of exercises and their aims are discussed (Table 1).

Drill exercises aim to strengthen individuals' knowledge in the practice of their profession. Drills repeat the key elements, such as the rescue services' fire-fighting techniques, police's use of weapons and ambulance personnel's life-saving efforts. Within one profession, methods for handling of common and recurring tasks are practiced. The philosophical origin of the drill can be found in the cybernetics, which is the science of automatization and mechanical control technology. In social context, cybernetics are routines contributing to predictability. It involves complex chains of events that are reduced to parts, including a limited set of factors,

during the drill. The concept of cybernetics comes from kybernetik (the art of controlling a ship) and is about steering a ship on the right course by adjusting the rudder (1, 3).

Strategic exercises aim to examine what outcomes different interventions may have on a catastrophe or disaster. Thus, the primary aim is not to teach staff at the operational level but rather to analyze the outcomes of different strategies under different conditions.

Collaboration exercises bring different organizations together and integrate actions across organizational and even national boundaries. Such exercises challenge the ability to use common resources in an optimal way. A collaboration exercise reveals the abilities to overlap, prioritize, and complement each other during actions.

Table 1: Exercise types, learning and benefit (Source, Berlin & Carlström, 2014)

Exercise type	Learning	Benefit
<i>Drill</i>	Copying, Repetitive skills	Routines
<i>Strategic exercise</i>	Knowledge of the effects	Concepts
<i>Collaboration exercise</i>	Flexibility, Resource optimization	Cross-organization behavior

The following sections of this chapter will focus on collaboration exercises. Drill and strategic exercises can prepare individuals, intra-organizational rescue teams, and entire agencies to become better at managing crises. Collaboration exercises, on the other hand, are necessary when autonomous parties must coordinate or even integrate their skills to handle a crisis (4-5). This is especially true for larger events with high degree of complexity but also for minor everyday accidents, when the first group arriving on the scene are few and lack competence in accordance to the size and character of the emergency (6). Collaboration exercises prepare for emergencies and improve the flexibility and efficiency at the accident scene (7). However, it is important to remember that collaboration exercises might produce limited collaboration-related outcomes (8), due to unsatisfactory attention to variation (9), dominance of mechanistic behavior (10), and insufficient focus on learning aspects (11). Nevertheless, they are regarded as the best possible option to prepare for collaboration at emergencies (12). These exercises can be played in two different settings; a) full-scale exercises and b) tabletop exercises.

a. Full-scale exercises: A full-scale exercise tests all functions in an emergency response plan simultaneously. Its aim is to allow professional emergency personnel to acquire an increased ability to enlist the help of each other on the operational level, to cross-organizational boundaries, and be prepared to act in an integrated manner (13-14). Such exercises are expensive, demanding and face several challenges due to time limitations and logistics. They are usually conducted in a real-time and do often play a real incident. They involve long waiting times and limited opportunities to examine different strategies (9).

b. Tabletop exercises: A tabletop exercise represents a discussion around a table. After presenting a scenario, professionals from collaborating organizations start to handle the emergency by prioritizing and making decisions (15). Tabletop exercises are used to practice common problem solving and coordination of services. Such exercises test disaster-plans, challenge collaboration to a low cost and simple preparation (16).

Arranging collaboration exercises is a challenge because a prevailing resistance to integrate responsibilities. Organizations tend to operate in parallel rather than collaborate and they often have difficulties in understanding each other's organizational models, concepts, action logics, legislations, hierarchical levels and agendas. During situations with resource scarcity or resource asymmetry, emergency personnel need to take the initiative to pull together across organizational boundaries. This is one of the key challenges when arranging an exercise. While collaboration seems to be the goal, participants are often occupied by repeating drills during the exercise. Each organization tends to focus on its own priorities and avoid the big picture.

Furthermore, participants seem to be happy doing tasks that they are used to but tend to be passive when unknown tasks must be accomplished (17-18). One reason for why the focus remains within the individual organization may be too large and too complex scenarios. With overzealous objectives, exercise leaders can expose participants to challenges beyond the ability. During such circumstances, the participants tend to simplify their actions and fall back on a well-known drill-behavior (19). Such exercises do not induce learning and can have an opposite effects to the expected outcome. The effects may be inter-organizational and inter-professional focus, inertia, and reluctance.

Exercises tend to exhibit constructed, artificial patterns that would not have occurred during an actual event. In contrast to actual events, they are made-up; thus, they can never entirely address occurrences that arise at actual catastrophes and disasters. In addition, the range of accident events that occur in the society are infinite and all thinkable scenarios can scarcely be exercised (20). Knowing that it is constructed by exercise leaders can promote behaviors that diverge from what occurs at an actual disaster scene, which prevents participants from achieving the learning that may be used at a real event. There have been reports of so-called “flawlessness behavior,” where participants show off their top personalities to impress on spectators, other participants, managers, and media (21).

On the other hand, when learning is in focus, the participants are keen to expose their own shortcomings, not hide them. During such an openness, the participants admit that mistakes will happen and that an exercise will support them to reveal their weaknesses. Successful exercises are understandable and provide space for learning, which results in new ideas. Activities that follow exercises are just as essential as the exercises themselves. Furthermore, learning is especially effective when participants from collaborating organizations and professions learn from each other. This can be arranged through open seminars where participants come together for discussion (22). Unsuccessful exercises duplicate the same errors exercise after exercise, similar friction is experienced, the same sources of frustration are documented, and even though they are emphasized, the difficulty is repeated at the next exercise. Such exercises do not provide the learning that is needed during disasters missions. Thus, developing educational initiatives, useful, and successful exercises is a challenge, particularly, if the aim is to improve preparedness to critical threats and events (7, 23).

Conclusion

Learning is one of the benefits of exercises. A constructive exercise results in new patterns of thinking and potential routines useful in crisis work. Consequently, learning stands for development and change. In contrast, crisis organizations tend to be predictable, stable, and repetitive and suffering from inertia. To challenge the common characteristics of crisis organizations, collaboration exercises require dynamics and capacity to develop, while going on. They need to switch strategies during a changing scenario, depending on the situation, and being open to several potential options. During disasters, change is about finding altered techniques to handle a situation by modifying the efforts in collaboration with others. The challenge is not always to rely on familiar standards but achieve the quickest and best results to save lives, limit the loss and come back to normality (11, 24).

Take-Home Messages

- There are several types of exercises, which can be used to prepare organizations involved in disaster management. It is crucial that instructors are aware of pros and cons of each type of exercise and training model.

- 2. Understanding the need for knowledge and competency for each professional and level of disaster and emergency management is necessary for setting up a collaborative, inter-professional and multiagency training in which roles, responsibilities can be defined, and teamwork can be practiced.

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Chapter 31

CIVILIAN MILITARY COLLABORATION

Glenn-Egil Torgersen, Herner Saeverot & Trygve Steiro

Summary

This chapter points to several core elements to achieve a good collaboration between the civilians and the military. A key point is that relations between the military and civilians should be established, planned, and trained before crises occur, as the relational aspects play an important role.

Introduction

Basic concepts

In most cases, the civilian emergency services in a nation or state can resolve crises on their own; either alone or in interaction with each other, and the military units are not needed as support. Nevertheless, in situations, where the challenges are substantial in the relationship between the content and extent of the crisis, and the capacity and competence of the emergency services, military units can also contribute. In other cases, the military will need support from the civilians in relation to, for example, stabilizing situations or bringing in emergency aid in a war-torn area. Different nations and alliances have their own laws and guidelines that regulate and control whether or when (which situations) can activate collaborative operations or other activities between military units and civilian organizational zones. There are three basic concepts related to collaboration between military and civilian organizations.

1) Civilian Military Collaboration (CMC)

CMC is a one important multiagency partnership, established to manage emergencies and disasters in both medical and non-medical perspectives (1). *CMC* involves non-military organizations, such as police, fire services, health services, educational entities, volunteer and humanitarian organizations, scientists/universities, private enterprises, and transport and logistics companies, that can collaborate with military services.

2) Total Defense System (TDS)

Some countries also have a regulated system where all actors in the nation, including the individual citizens, have a responsibility to contribute and cooperate in the event of serious crises or attacks. This takes place under the leadership of the Armed Forces, the Police, *or* other defined organizations. This system is called *the Total Defense System*.

3) Civil-Military Cooperation (CIMIC)

In a more military context, where the military organization (such as an alliance) acts as the responsible for the collaboration, often as a part of a larger military operation, is called *CIMIC*. An example might be NATO's definition: "Civil-military cooperation (CIMIC) is a joint function comprising a set of capabilities integral to supporting the achievement of mission objectives and enabling NATO commands to participate effectively in a broad spectrum of civil-military interaction with diverse non-military actors" (13).

The present chapter explains what *CMC* can be in a broader context (including at TDS) than the more military oriented *CIMIC* approach, and what it takes to make this work in the best possible way.

What is civil-military collaboration?

CMC, seen from a military perspective, is to support civilian society via five militarily interlinked organized areas of competence:

- a) **Military armed force units:** Use of forces with weapons support.
- b) **Logistics and training units:** Support for transport, training and planning of supplies, strategies, and equipment.
- c) **Sanitation / health units:** Medical expertise
- d) **Engineering units:** Often including cyber, support with equipment (e.g., in connection with hazards, bridge construction, etc).
- e) **Other units:** Separate military units that focus on civilian support, such as the Home Guard/ civil defense and other organizations that may be different in different nations.

What are the areas for collaboration?

There may be threats, crises, and events, which necessitate CMC due to special challenges in ten areas:

- **Scope:** The crisis incident affects many and over a large area, or several areas simultaneously or sequentially. More specifically, threats can affect at different levels, from a personal level to a local and global level. The scope of a threat can also affect generations existing in the future (2).

- **Unforeseen circumstances:** The incident occurs surprisingly, with little time for preparation, contingency planning, prevention, and insertion of barriers that stop the incident or may reduce the impact of incidents.

- **Simultaneity issues:** These issues generally occur at the same time and that different organizations must distribute resources and attention to different domains.

- **Disasters caused by nature or environmental factors:** These disasters generally require a large amount of resources and coordination

- **Threats due to hostility:** Where the boundary between the terror and the war is unclear. Some attacks in recent years have been hybrid.

- **Threats with unintended consequences:** These will involve large parts of society, i.e., climate change and pandemics.

- **Cyber Attacks:** These can also be combined with other attacks.

- **Research and development of concepts:** Peaceful collaboration between competence units in research related to both military and civilian purposes (e.g., Charles Darwin was transported to HMS Beagle)

- **Human security and hybrid threats:** Military protection of civilians and other security measures to protect individuals or groups. May be relevant during crises and internal strife, possibly also hybrid threats (several different attacks or threats which occur simultaneously at the same time).

- **Society of warfare and sustainability:** Innovative approaches, future prospects for possible new conflict systems, not only based on traditional patterns (i.e., Cold war, cultural conflicts), but also possible new and complex challenges that can escalate. Holistic considerations via all social actors and newer organizational structures in Civilian Military collaboration; about what conflicts and threats may become in the future, including a focus on sustainability and existential threats that may cause damage or danger to the well-being and survival of humankind (3).

Different views on the relationship between military and civilian organizations

CMS gets its legitimacy and organization depending on classic (1) or newer (2) models.

1) Classical models - Avoid power problems

Older models about the relationship between civilian and military organizations often draw a sharp distinction between these. There are two approaches:

- *The State as the starting point*

According to the political scientist Samuel Phillips Huntington (1927-2008), the solution is to establish objective civilian control. The government should have here undisputed authority over issues related to war and peace (4). On the other hand, the military has undisputed authority to choose what kind of operations will best achieve the goals set by the government. Huntington bases its model on three assumptions. First, the state

must be the starting point for all military activities. Furthermore, competition between states must be rational for the military activity. Third, the civilian control and military efficiency are maximized by keeping military activities separate from society throughout the establishment of a professional corps of officers (Huntington, 1957, pp. 82-94).

- *Balanced collaboration*

The sociologist Morris Janowitz (1919 - 1988) agreed with Huntington on the fundamental differences within civilian and military world. However, Janowitz disagreed on how the relationship between the two should be (5). According to Janowitz, the military world is fundamentally conservative, hierarchical and based on stovepipe leadership and communication structures (C&C – Command and Control). This type of design leads to a military activity that hardly changes and does not adapt as quickly as the civil society does and needs. Janowitz, therefore, argued for a closer and more balanced collaboration between society and the military organization (5). However, this presupposes adaptations from both actors, both in terms of management, language (codes and industry language) and culture. Last but not least, the will is needed, both among the actors and among the authorities, to achieve this.

- *Society's situation and customized solutions*

Huntington and Janowitz represent two different classical views of how the relationship and interaction between communities and military organizations should be. While Huntington describes that the military organization should be separated from the community and where a professional corps of officers is necessary, Janowitz describes a military organization that will reflect the civilian society and how conscription is crucial for this to happen. However, both Huntington and Janowitz perspectives are based on the social situation of their time mainly focusing on:

- After World War II with Cold War tensions,
- Great-war threats between well-defined countries and alliances,
- Arms races and political measures for balance of power,
- Their own professional and disciplinary background,
- Analyzing with western eyes.

2) Modern and forward-looking models – Building synergies

Newer models of the interaction between military and civilian organizations tone down the actual structural difference between the organizations and are adapted to the new security situation and the security policy in society. Two focuses are central:

- *Internal challenges*

This can reduce the exchange of information, competence, and innovation (6). This then applies to both military and civilian organizations, both public and private enterprises. At the same time, the goal is to reduce the differences between civilian and military units, so that they can interact better, precisely to build synergies in strategic competence and technologies to be stronger in the face of the unforeseen challenges of the future (6).

- *Unforeseen and hybrid threats*

The understanding of threats is more diverse than before. There is now more talk of hybrid threats, which can consist of many types of simultaneous and unpredictable attacks and threats, such as cyber-attacks, terrorist-like attacks, environmental damage, etc. (some of which occur simultaneously). Moreover, the alliance picture in the world has become more heterogeneous and complex than during the Cold War. In addition to national lines of conflict, it is necessary to be prepared for CMCs related to dealing with different groupings, both within and between countries, often across continents.

Basic principles for better CMC collaboration

Therefore, military and civilian units must also collaborate more and better to deal with such threats. It requires both a more common mindset and, at the same time, an emphasis on diversity, creativity, and

judgement, in practice, in education and in exercise. Joint development of competences for the unforeseen events must be the goal (6, 11). To achieve this, the actors must satisfy three principles:

a) Develop a common understanding of what it means to "collaborate"

Whatever the word is used (e.g., interaction, collaboration, cooperation, communication, coordination, teamwork, joint force with), and specifically which conditions and which competences are needed to achieve such collaboration, must be clarified in strategic plans and curricula, common between the military and civilian systems (6). For example, the experiences from the management of the earthquake in Haiti (2010) showed that different emergency services had different understanding of and different training in collaboration. This created problems for the effectiveness of the collaboration when many organizations were involved (6).

b) Avoid organizational narcissism

Crises give organizations an opportunity to show themselves. Leaders can often be preoccupied with getting awareness of themselves and their own organization's good coping skills. It is easy to think that you know best. The consequences may be less recognition of other organizations' expertise and resources. This is very unfortunately and can cost time and resources. One spends time on quarrels, while the crisis worsens around one.

c) Create joint action

Hazards are easier to get cooperation with when you have experience with it, and it is often clear who is doing what (7). In other situations, it is more unclear who does what. Military organizations that want to stabilize the situation may even want to distribute food and supplies to a population to create relationships and goodwill. This can come into conflict with civilian aid organizations who see it as their task. It can also make the difference between those who are combatants and non-combatants. It can also create unhealthy competition between different organizations and create an overall uncertainty.

Guidelines for establishing effective Civilian-Military Collaboration

The following steps are essential for effective and resilient collaboration:

Step 1: Establishing top-level leadership commitment and judgement for collaboration

One of the more robust findings in the field of organization and leadership theory is the importance of top leadership commitment and use judgement. Whereas leadership is executed on different levels, the top level can provide direction, prioritizing and allocating resources and finally, establishing common ground for learning and development.

Step 2: Preparation and Planning

Before starting the process of establishing collaboration, planning is essential. Planning processes is also about building relations. It is often said that plans are nothing, or planning is everything. However, both plan and planning processes are important and cannot be separated.

Example: The Dutch business theorist Arie de Geus (1930-2019) points out that the scenario building enables multiple scenarios to be developed (8). But more importantly, it enables conversations between people inside the company and outsiders of the company that can be viewed as driving forces of social, political, or technological nature. de Geus's (1998) findings can open and invite for double-loop learning (9, 10), which means teaching people and organizations to think more deeply about their own prerequisites, coping skills and opportunities for success. See also point 6.

Step 3: Get to know each other properly and collaboration – under risk

It is important to get to know each other properly. National and organizational culture can influence these processes. In some cultures, there is a more informal approach. In other cultures, building trust and relations takes time. Nevertheless, it is essential that the parties build a common understanding of what it takes to

establish effective collaboration or interaction, not only under predictable and safe conditions, but also under risk and unpredictable conditions (10).

Example: “When in Rome, do as Romans”. In some cultures, like Afghanistan, three cups of tea are necessary to build bonds. A contract might not postpone the process. Know the customs and try to understand the culture.

Step 4: Recognize each other competence and culture to ensure complementary

It is important to identify and emphasize complementary competence (6). In addition, it is necessary to emphasize mutual respect and creating hospitality as importance means for creating a basis for collaboration (11). Central are also each other's organizational cultures, management systems and interpretive frameworks, not only superior between military and civilian organizations, but also internally within these.

Step 5: Agree on unambiguous roles and responsibilities for cultural differences (internal and external, and interpretive frameworks) - even within the military

The clarification of roles and responsibilities must be made clear and established in agreed plans and regulations. At the same time, these must also be able to be adjusted and adapted to changing situations and needs. Thus, routines must also be created for how such adjustments can take place, with the participation, acceptance, and control of all relevant parties. Uncertainties here could create misunderstandings and reduce the effect of practical collaboration.

Step 6: Arrange training and exercises in “peacetime” and a Common Pedagogical Doctrine (CPD)

In the military, there is a saying: “Train as you fight” meaning that training should be adequate for what is expected in war time. A common pedagogical doctrine (PDS) or a basic pedagogical view should be developed (12). It should include a description of key pedagogical concepts (as “collaboration”) and learning methods for training and knowledge development, and which are understood by all parties.

Example: Mend the roof on a shiny day. Good and effective collaborations take time and must takes time. Find common ground and find areas that could be trained on. This can vary from tabletop exercises on paper to full-scale exercises.

Step 7: Evaluate, unlearn, and learn from each other

Establish both formal and informal arenas for knowledge sharing and development. This is essential for further development and facing the next crisis. Learning can find a place both formally and informally. Sometimes we need to unlearn as well, as our knowledge may be false or obsolete. Key questions: Are we doing it right and are we doing the right things? May our knowledge be false or outdated?

Conclusion

In a complex world, military and civilian organizations, which are involved in handling different crises, look to each other for common ground. Some situations require all available resources, while in other situations collaboration is an option. In this chapter we have provided some guidelines that should be followed. These steps are not necessarily linear and will be intertwined in time. Top level leadership addressing the importance of collaboration is needed. Plans (the product) and the planning process is equally important. Being culturally sensitive is important and demonstrating mutual respect for each other's skills and competence is important. Finally, learning within organizations and between organizations is important to evaluate the efforts and be prepared for the next crisis.

Take-Home Messages

- Top-level leadership is essential.
- CMC has a great potential to create synergies but need to be approached by different angels to be effective.

- Develop Common Pedagogical Doctrine (CPD).

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Chapter 32

FUTURE DEVELOPMENT AND FINANCIAL CONSIDERATIONS IN DISASTER MANAGEMENT

Glenn-Egil Torgersen, Herner Saeverot & Trygve Steiro

Summary

Preparedness costs: in a complex world and a dynamic society, finance plays a crucial role in understanding disaster management. Finance can contribute to growth in society and be an enabling or disabling factor for dealing with disasters and other destructive forces.

Introduction

Lessons learned

The main lesson obtained from these older models is that almost all parts of a system and society are connected. Each human has weaknesses but also a unique power. Therefore, growth and development in society must be understood as a whole, where everything is connected. If something or somebody fails, the whole can help preventing negative outcomes, and the developments can still occur.

Risk management in a dynamic society – the cost-benefit issue

In recent and future-oriented analyses of the relationship between finance and emergency preparedness, there are four approaches:

1) The “Economic man”

It is argued that our rational understanding is limited (7). There are challenges in modern business’ navigation between disasters and accidents, ensuring a high safety standard and at the same time keeping the safety at a healthy standard (2), meaning that too much safety efforts can ruin the business. Therefore, dealing with disasters is not easy, questioning whether the existing safety and preparedness are sufficient to deal with the crisis.

2) High Reliability Organization (HRO)

Other researchers (8) call for a more dynamic way of dealing with safety, what has been termed High Reliability Organization (HRO), which encourage to see all the parts of a system, as in a context. By turning around their findings to organizations with very reliable performance, one may suggest that less reliable organizations may be characterized by a failure to build organizational redundancy and by a failure to adapt the organizational structure in the face of demanding situations (8).

3) Commitment to resilience

The introduction of “mindfulness” aims at capturing prominent characteristics of HROs, accepting the fact of failures, and that there is no perfection of zero error (9): Preoccupation with failure, reluctance to simplify interpretation, sensitivity to operations, contain the unexpected, commitment to resilience (power to handle), and defense to expertise.

The HRO is not necessarily an ideal concept from an economic point of view since it is very focused on redundancy and therefore might be perceived too costly. It is costly to argue for overlap in a business world, which favors optimization, cost cut and profit.

What does it take to create a sustainable and fair economy?

There are four main models or systems to choose from, all of which have their advantages and disadvantages regarding future financial, disaster and emergency planning.

System 1: Market economy

This system focuses on revenue and profit. The advantage of the system is that the money made can be used for investment in something that in turn can be further developed - for further sale. The disadvantage of this system is that human nature and needs, both psychologically and in terms of value, come second since people are considered as “resources”. This can lead to unfortunate attitudes, even if the intention is good.

System 2: New Growth Economic theory

This system is more focused on internal factors and the organizations’ ability to create capabilities such as knowledge and entrepreneurship. It is also very concerned with technology and considers technology as a means in which individuals can access the economy and thereby create profit. This can have an economic impact both for the individual and collectively.

A crucial aspect is individuals who are pursuing physical, personal, and financial wants and needs by investing in ways that enable them to meet certain needs and wants. In sum, human capital thinking can be seen as the key feature for system 2 and that is the main difference between this system and system 1.

System 3: Planning Economy theory

This system focuses on the state, and its role in setting production standards, planning and means to achieve them. The economy should be planned within a limited period, i.e., 5-year plan in which the amount of a product that the nation wants to produce is assessed.

The challenge is of course the need of resources to assess the production goals, setting production goals and following up them. Another challenge is the prediction of the future. Another feature in system 3, with centrally commanded economy, is its ability to provide an overview of production numbers. While this can provide more foreseen future, the strive for more optimal and sustainable production might not be that strong. Therefore, in many societies, the principles of system 1 and system 3 (or also system 2) are combined and are then called a “mixed economy” system.

System 4: Existential growth

The concept of deep ecology describes as a system based on a holistic conception of reality, and considers human as a part of the total nature (6). In this perspective, people, animals, and plants interact, and everything depends on everything else. Sustainability in this perspective means to support or maintain. The advantage is that no more than the growth in renewable resources is used. Another advantage is that quality of life is perceived as a fundamental value since it is an integral part of the whole.

What system is best for handling future disasters?

A combination of the systems opting to gain advantages from all systems would be preferable for dealing with future disasters. The mix of course is not easy to obtain but the society should strive for it. It is theoretically possible to achieve economic growth, while quality of life is safeguarded, and the environment is protected. However, the problem is that the idea of continuous economic resource development often comes first, so that the principle of justice is easily put out of play. We will need more of system 4 to be an integrated part of the financial system to ensure a sustainable future.

Ways forward and principles for establishing a better risk financial management and fundamentals for future financial challenges

There are eight principles that mainly show what is needed to achieve the best possible growth in society.

1. **Values:** What are important values to be prioritized (value portfolio). How can we use financial tools to help achieving our values? One answer may be to agree on values that are important and should be given particular attention with short-term versus long-term goals.
2. **Rationality:** We must develop our understanding of human cognition and economics. How should we motivate people or organizations to act more rationally on the behalf of humanity? We need to better understand and execute decision on an individual, group, organizational, and society level. Starting with the person in the mirror should be given particular attention for understanding financial behavior.
3. **Systems reflection:** We must all promote thinking and concrete actions that go beyond classical economy and financial models, such as systems 4. Growth in today's and tomorrow's society will require interaction and focus on justice, values, and global sustainability. The answer is not clear, but reflection and awareness of system 4, can be a starting point - for you, your family, the authorities, and society in general: All for the benefit of society (11).
4. **Education:** Educate people in understanding different perspectives and financial models. Critical voices believe that business schools promote a view of people as economic actors. This leads to the assumption that people are motivated by money and profit (10, 7). The assumption is not wrong; however, it is too narrow. Awareness of basic assumptions in different educational programs are therefore important.
5. **Interdisciplinary and ethical thinking:** Embrace complexity, rather than simplifying interpretation and understandings. Foster systemic thinking. Whilst students need to have some form of disciplinary training, the education should also foster a curriculum of interdisciplinary training (11). Training of managers should include handling complex scenarios that force interdisciplinary thinking and ethical aspects (12). This will also include financial aspects and see finance in relation to other factors as well.
6. **Preparedness:** Build robust capabilities for preparedness rather than being fixed for certain scenarios. We need to focus on learning during economic crises and other crises, such as pandemics. We need to become better at accepting that not everything can be calculated, and therefore it is important to preparedness for the unforeseen (13). See also point 4 and 5. Be prepared for new forms of financing and currency system (Bitcoin) and risks associated with them.
7. **Chaos theory and the Unforeseen:** Establishing learning and unlearning as a part of the organization and between organizations. More focus on chaos theory, including people's relationship to the unforeseen, in economics and finance educations. For example, there are lots to be learned from the COVID-19 pandemic about how people react to unpredictable events and those who commence the rules and regulations. Unlearning what is false or obsolete can open a diversity of possibilities by which we make and live the world (14). This thinking can also be relevant in a financial perspective (13).
8. **Justice and judgment:** There is no one theory of justice that answers what is fair to all individuals or institutions (15, 16). Justice must be discussed on a case-by-case basis. What is perceived as fair to one person may be perceived as unfair to another person. Justice must therefore be placed in a context, and it requires judgment from case to case on what may be fair (15-16).

Conclusions

In a dynamic society, finance plays a significant role, both as an enabling and disabling factor. Understanding risk is also about understanding economics. Dealing with economic considerations should better prepare us and assess more areas regarding risks. During the current COVID-19 pandemic, companies and well-known manufacturers contributed to the production of medical devices and Personal Protective Equipment (PPE). Such engagement may indicate other ways of financial contribution during disasters and public health emergencies, while direct financial investment and support remains the number one. Whatever the

contribution, financial considerations should be incorporated in the planning for future battles against disasters and emergencies.

Take-Home Messages

- Broader perspectives on financial aspects as both enabling and disabling factors.
- We need a broad discussion on what a sustainable economy is.
- More interdisciplinary collaboration in education and in decision making in the public, private, and the third sector to ensure justice and sustainability.

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Marius Rehn, M.D., Ph.D.

The book provides a thorough and well-written introduction to several relevant aspects of disaster management.

Amila Ratnayake, Lt Col (Dr)

You have done an admirable task with your vast experiences in this domain to provide a vital resource to a wide array of scholars, public health care professionals, health care managers, governmental and non-governmental officers engaged in disaster care.

Handbook of Disaster and Emergency Management

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