

Impacts of disasters on health system performance, security and health protection

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Abstract

Purpose: Disasters may have direct and indirect impacts on the population's health and healthcare system. Deaths, injuries, psychological effects, and diverse diseases can be measured in varying degrees of rigor and substance. Indirect impact factors (e.g., losses to primary healthcare and living conditions, damages to healthcare systems and external infrastructures, provision of water and/or electricity) including their consequences are very often not subject of attention. The purpose of this study is to identify various impacts of different European disasters on health system performance, security and health protection with focus on psycho-social support. This study is part of the international multi-disciplinary project PsyCris (PSYcho-social Support in CRISis Management) that is funded by the European Union with the overall objective to improve psycho-social support in crisis management.

Methodology: Based on different impact models the authors present an analysis of impacts of five European disasters. The collection of the data was organized by a questionnaire that serves as assessment tool for each disaster. The questionnaire consists of different questions concerning the disaster and its management. In this regard existing material (e.g., reports, articles, films, photos) served as foundation in answering the questions. Additionally, interviews with people, who were involved in the management of each disaster, complemented the questionnaire.

Results: The analysis of the case studies has shown that each disaster causes aftermaths in different fields. Many identified impacts are the result of a learning process because of inadequate outputs during and after the disaster. For example, because of the fact that during the avalanche in Galtür (Austria) the psycho-social support did not work, the Red Cross founded the KIT (crisis intervention

team), which represents a long-term impact on the health system performance. In Lithuania we have identified health protection measures such as individual consultations in advance of a flood with the objective to inform newly settled residents to be better prepared in the case of the flood (e.g., long-term impact concerning preparedness planning).

Conclusions: Different impacts of disasters on the health system performance (e.g., changes and adaptations in medical, psychological or psychiatric treatment, psycho-social support) and on security and health protection (e.g., optimisations in contingency/preparedness planning, infrastructure, training, increase in security research funding activities, information and communication measures) have been identified. The analysed communities have engaged in different types of emergency management and risk reduction interventions to minimize further disaster's impacts. The results have shown that hazard mitigation and emergency preparedness practices can reduce direct and indirect impacts because of reflections and learning experiences.

Keywords: Impact of disasters, health system performance, security, health protection, psycho-social support

1 Introduction

Disasters may have direct and indirect impacts on the population's health and healthcare system [1]. One aspect is the identification of direct health consequences of disasters. Deaths, injuries, psychological effects, and diverse diseases and illnesses can be measured in varying degrees of rigor and substance [2]. Along with the population's health, the healthcare system itself can be affected by disasters due to damages and/or losses of personnel. Frederick et al. [2] have remarked that the indirect impact factors are very often not subject to planning or political attention and mostly remain undetected, unmeasured, and under-evaluated. The indirect consequences of disasters refer to not only losses to primary healthcare and living conditions and to limited or no access to administration, but also damages to healthcare systems regarding external infrastructure such as the provision of water and/or electricity [1].

There exist a number of different impact models with the objective to identify relevant impact variables [1, 3-9]. The diversity of impacts is enormous. For example, Boyd et al. [10] clustered them into different categories: affected public, inter- and intra-organisational collaboration, preparing responders and their organisations, prioritisation and decision-making. The category "affected public" refers to the recovery of the public, engagement with community groups and vulnerable populations, public risk communication and information and finally, the use of social networking. The category "inter- and intra organizational collaboration" deals with collaboration across multiple organisations. A considerable number of healthcare and non-healthcare organisations are potentially involved in prevention and recovery measures across the public, private, and voluntary sectors. Large-scale emergencies require

collaboration across administrative boundaries in close coordination within brief time spans [11]. The category “preparing responders and their organisations” focuses on the learning and quality improvement in offering exercises and training measures for the people involved. Finally, the last category “prioritisation and decision-making” refers to the context, i.e. the social, administrative, and political context where the disaster occurs. Here, the priority and resourcing given to emergency planning and management, issues relating to organisational change as well as leadership and decision-making support systems during crisis are important pillars of this category [10]. The complexity and interdependencies make large-scale emergencies particularly challenging.

Finally, each disaster is specific because of the circumstances what happened and where and when it occurs. Lindell [12] developed another framework for disaster research that also considers social impacts (see Figure 1). Lindell’s [12] concept of social impact consists of elements from the World Bank’s report and is presented in an article by Lindell, Prater and Perry [6]. It consists of three pre-impact conditions: exposure to hazard, physical vulnerability, and social vulnerability. Three specific event conditions complement the framework: hazard event characteristics, improvised disaster response, and improvised disaster recovery. The hazard event characteristics and improvised disaster response, both parts of the event-specific conditions, in combination with the pre-impact conditions produce the disaster’s physical impacts that, together with recovery actions, consequently produce a disaster’s social impacts.

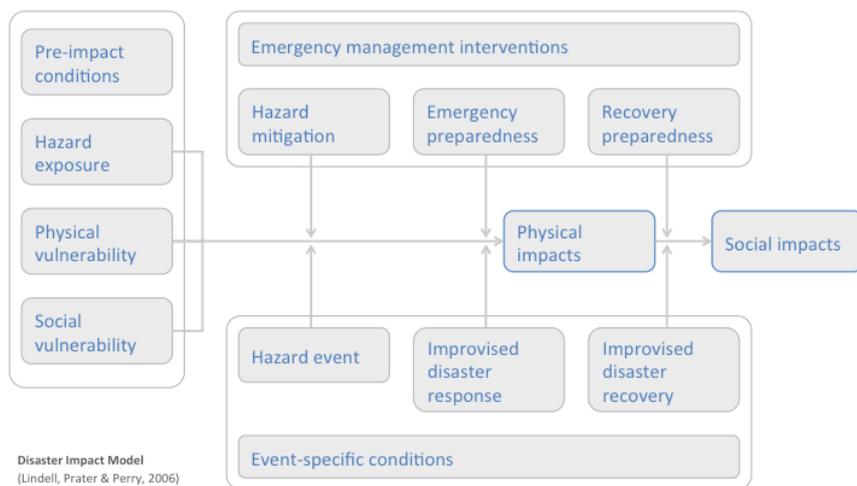


Figure 1: Disaster Impacts (Lindell, Prater, and Perry [6])

Lindell [12] has argued that communities can engage different types of emergency management interventions to reduce a disaster’s impacts. It is argued that hazard mitigation practices and emergency preparedness practices can reduce physical impacts and social impacts.

This paper focuses on the direct health consequences of disasters and the impacts of disasters on healthcare system performance, security and health protection measures. Health system performance usually refers to four basic functions such as financing, creating resources, stewardship and delivering services [13]. This may increase the demand for psycho-social support, psychological or psychiatric treatment, but also treating concerning other diseases such as chronic diseases. It has a direct effect on delivering services including financing questions. Security and health protection usually either referred to post-disaster efforts aiming at optimising contingency and preparedness planning, infrastructure and training or an increase in security research funding activities as well as information and communication activities.

2 Methodology

Case Study Approach

The decision for using a case study methodology was made first to accommodate the complexity of disasters. This research approach allows the representation of complexity and the specific circumstances of each disaster. Disasters, including their management, can be seen as a system consisting of different subsystems and functions. Everything is related, and nothing should be considered in isolation. As such, we needed a holistic system-centred way of thinking [14].

Second, a case study approach allows for the integration of a wide range of methods for analysis. We followed the World Bank report in integrating qualitative and quantitative information for impact analysis in order to better understand social phenomena [15,16]. Joffe und Mindell [17] have also suggested the use of existing qualitative and quantitative data and studies for public health impact assessments, with the objective of combining them.

We built upon contrasting cases [18] since a variety of contexts, circumstantial factors, and their impact on each case could offer a more complete picture of impacts of crises on healthcare systems. For analysis, five specific cases from Spain, Lithuania, Luxembourg, Austria, and Germany were reconstructed to form the foundation for single case reports. Table 1 presents an overview about the chosen case studies.

Country	Case	Interviews
Spain	Terror Attack (2004)	Crisis Managers, Forensics, Psychologists
Lithuania	Flood (1999 – ongoing)	Civil Protection Department
Luxembourg	Airplane Crash (2002)	Airport Personnel, Crisis Managers, Social Worker, Politicians, Priest
Austria	Avalanche (1999)	Crisis Managers, Psychologists, Politicians
Germany	School Shooting (2002)	Ministry of Education, Health Insurance

Table 1: Case Studies

The Questionnaire and Expert Interviews

The literature and field research efforts produced a comprehensive register of benchmark data and textual material with key stakeholders. We put special focus upon the development of a questionnaire as an exploratory tool for capturing both various dimensions of crises in the European context and distinct crisis management responses. Based on the findings of the literature review the questionnaire was developed as an exploratory tool for investigating and health assessing system effects. Apart from findings of our literature review, additional expert discussions and interviews with relevant stakeholders and endorsers supported us in identifying the central topics and problems. The questions address different impacts of crisis on public healthcare. The main categories of the questionnaire are: General information about the chosen major incident, specific information concerning the chosen major incident, general coping strategies and direct effects on health, direct costs and follow-up costs (in €), long-term effects on the public healthcare system and long-term effects on culture and the community.

Though the questionnaire was employed as a data gathering instrument of existing source material, also interviews with at least three local stakeholders who were involved in the disaster management of a disaster were conducted. The interviewees provide first-hand data of the specific incident chosen, with the objective of identifying additional impact factors. The analysis of the interviews applied the qualitative analysis method GABEK (GAnzheitliche BEwältigung von Komplexität), which supports the structuring of expressed experiences, knowledge, and perceptions of participants in order to provide a comprehensive view of the individual aspects of the particular situation investigated [19].

In the following the results we have attributed to the health system performance, security and health protection are presented for each case study.

3 Findings

First we present an overview about the single case studies regarding number of affected people with focus on dead and injured people. Table 2 shows the direct health impacts concerning dead and injured people of the different disasters. Unfortunately no or less information is given about detailed injuries or further consequences for the people affected with regard to mental problems or diseases.

Case	Number of dead & injured
Spain – Terror Attack	192 dead 1.857 injured
Lithuania – (annual) Flood	no information concerning dead/ injured
Luxembourg – Airplane Crash	20 dead 2 injured
Austria – Avalanche	31 dead 22 injured
Germany – School Shooting	17 dead 6 injured

Table 2: Direct health impacts (dead & injured)

Table 2 shows the dimensions of each disaster. Compared to the other disasters the terror attack in Spain causes most of the dead and injured persons. The dimension is also expressed in the estimated costs – when available - of the each disaster. For example, the estimated costs for Spain were 212.000.000 Euros compared to Austria with 10.000.000 Euros.

In a next step we present the main results with regard to impacts on health care systems, security and health protection with focus on psycho-social support (Figure 2 and Figure 3). In the following we explain shortly for each case the most important impact(s) we have identified based on the data of the questionnaire and interviews. We start with Austria, followed by Luxembourg, Lithuania, Spain and Germany.

Health System Performance – Psycho-social Support				
Austria	Luxembourg	Lithuania	Spain	Germany
Establishment of KIT by Austrian Red Cross	Better integration of PSS into rescue plans	Visit homesteads after the flood	Formation of Special Psychological Care Unit	More psychologists with education in traumatology
Uniforms for emergency psychologists (identification)	Significance of different needs of the target groups		Psycho-social support for rescue workers in their organisations	Better integration of educational psychologists into crisis intervention
Improved cooperation and coordination in Red Cross and between other rescue organisations	Higher interest of persons willing to enter the GSP group		Optimization of the cooperation in hospitals	Self-help group for the family members
Coordination with health insurance concerning psychological treatment and assumption of costs				

Figure 2: Health System Performance and Psycho-social Support

Security and Health Protection – Psycho-social Support				
Austria	Luxembourg	Lithuania	Spain	Germany
Update checklists	Establishment of a crisis support centre	Visit homesteads before flood to inform residents	New psychological plans	Update emergency plans
	Adaption of emergency response plan	Information for newly settled residents	Training for special groups	Update contingency plans
	Continuous revision of national rescue plan	Trainings for Red Cross volunteers	Drills	Specific trainings for different stakeholders
	Exercises and training courses with focus		Modification of emergency plans	Emergency folders and brochures for different stakeholders in schools
	Improved cooperation between fire- and rescue teams and GSP		Development and adaption of different protocols	
	Checklists		Adaption of civil protection plans on national level	

Figure 3: Security and Health Protection and Psycho-social Support

Because of the inadequate provision of psycho-social support during the avalanche disaster in *Austria* the establishment of the KIT (Kriseninterventionsteam) by the Red Cross is one of the most relevant impacts in the context of the health system performance. Missing structures and management have created a disorder (for example too many psychologists, no identification because of missing uniforms, reporters who masquerade as psychologists, etc.) which had negative psychological impacts on the locals of Galtür.

As result of the airplane crash in *Luxembourg* we identified a number of new formations of units, committees, teams and centres. As in the other cases also the revision of emergency plans, national rescue plans or national hospital plans were undertaken. Finally, a growth of volunteers was observed who wanted to join “Groupe de Support Psychologique” because of the number of media reports. The structure of psycho-social support itself has not changed. One learning experience was to adapt more on the individual needs of the people affected.

Lithuania is confronted regularly with a natural disaster, the residents of certain areas are confronted with annual river floods because of the snow and ice melting along the river area or long-lasting rain. In this context visits before the floods, especially in the case of new settled residents, are organized. Guidelines

for the behaviour in the case of floods as well as operations plans for vulnerable groups have been developed and adapted regularly. Additional trainings are offered for Red Cross volunteers and for pupils in schools. For the psycho-social support supply visits after the flood have been organized to check the living and health conditions of the residents.

As in the other case studies, also in *Spain* a number of plans (e.g. emergency plans, civil protection plans, psychological plans) were developed or adapted after the attack. Additionally, training measures for special groups and drills were organized with the objective to identify problems. In the context of psycho-social support the extent of the event has led to the formation of a special psychological care unit which takes over the organisation and management of psycho-social support. Because of the extent of the terror attack a systemized supply of psycho-social support for rescue workers in their organisations were established. After the terror attack the need to improve the cooperation and collaboration between staff members in hospitals, but also between the staff members and psychologists became explicit in order to enhance health care delivery.

After the school shooting in *Germany* an important impact with focus on health system performance mainly refer to changes in the provision of psychologists who dispose of a background in traumatology. Additionally, a better integration of educational psychologists is seen as relevant backup for the crisis intervention on-site. In the case of Erfurt a self-help group of family members was organised to support themselves in dealing with the school shooting.

4 Discussion

The analysis of the case studies has shown that each disaster causes aftermaths in different fields. We experienced during our analysis that learning circles play a significant role in the context of crisis management. Many identified impacts on health care systems are the result of a learning process because of inadequate outputs in the past. Moreover, most of the identified impacts of the different case studies are the result of each disasters' collected experiences and reflective analysis of operations and results (e.g., which implications can be drawn because of operations that lead to the adaption of emergency plans, communication structures, laws, infrastructure, etc.). As the detailed analysis of each case study has shown, new structural, procedural, and legal concepts have been developed and implemented in elements of public health systems.

Each disaster is characterized by event specific conditions, pre-impact conditions, the existing physical and social vulnerability of the people affected and the standard of the emergency system. Health care measures have to react differently, depending on the recovery needs of the people affected. Because of the village structure in Galtür, Austria, the locals supported themselves when coping with the disaster. For this reason, the demand for psycho-social support in the short- and long-term from outside experts was not given. This has a direct effect on the health care system's demand-level for psycho-social support.

However, different recovery needs have been identified and stressed depending on the different dimensions and contexts of the analysed disasters, analysed as well as different system conditions.

During the analysis we were confronted with the following problems by analysing the questions from interviews and questionnaire. Almost no reliable quantitative data was available. The responses to questionnaires were not comprehensive because of missing data. Some databases are not always valuable resources, additional personal contacts and expert knowledge were needed to provide further reliable information. We learned that disasters with higher public interest dispose of more investigations and documentation (e.g. Spain, Austria) when compared to others (e.g. Luxembourg, Lithuania). In this regard, we were also confronted with the problem of judging the quality of evidence from different sources. For example, in the case of the avalanche in Galtür, Austria, we were confronted with divergent data. There is no unique database available.

Finally, several problems of ex-post analysis can be identified because of concealments, glorification, objectifications of decision makers' actions, or problems of political exploitations.

We share the recommendation expressed by Verger et al. [20] of the need for health evaluation programmes after disasters to allow more thorough impact analyses. This must be designed holistically in order to measure direct physical and mental health effects, as well as indirect health effects like job loss, schooling consequences, and so on in order to identify the multilayer impacts of disasters. For example, alcohol abuse – caused of inadequate coping strategies of an individual after a disaster - may cause an inability to work. There is a need for more qualitative analysis of case studies that may support the process to identify further impacts of disasters.

5 Summary

The case study analysis focusing on impacts of disasters using a questionnaire approach in combination with interviews with relevant system stakeholders provided us insights into a disaster's effects on the health care system with special focus on health system performance as well as security and health protection.

We have identified many impact variables in conjunction with different time frames. The impact variables and time frames depend on the nature and extent of the disaster, affected people, existing infrastructure etc. The attribution of impacts to the categories “health system performance” and “security and health protection” has been proved as reasonable and gave a first systematisation of impacts.

Our chosen holistic approach gave us deep insights into each case study and helped us to better understand the undertaken or missing reactions concerning health care systems. Based on the learning experiences of the case studies we are able to evaluate key strategies and measures from a health care system perspective.

6 References

- [1] Shoaf, K. I., & Rottman, S. J., Public health impact of disasters. *Australian Journal of Emergency Management*, 15(3), pp. 58-63, 2000.
- [2] Frederick, M., Burkle, Jr., Greenough, G., Impact of Public Health Emergencies on Modern Disaster Taxonomy, Planning, and Response. *Disaster Medicine and Public Health Preparedness*. Vol. 2 No. 4. pp. 2-9, 2008.
- [3] Berggren, R.E., Curiel, T.J., After the storm - health care infrastructure in post-Katrina New Orleans. *New England Journal of Medicine*, 354, pp. 1549-1552, 2006.
- [4] Donker, G. A., Yzermans, C. J., Spreeuwenberg, P., Van der Zee, J., Symptom attribution after a plane crash: comparison between self-reported symptoms and GP records. *British Journal of General Practice*, 52, pp. 917-922, 2002.
- [5] Ferrando, L., Galea, S., Sainz Cortón, E., Mingote, C., García Camba, E., Fernandez Liria, A. & Gabriel, R., Long-term psychopathology changes among the injured and members of the community after a massive terrorist attack. *European Psychiatry*, 26, pp. 513-517, 2011.
- [6] Lindell M.K, Prater C.S, Perry R.W., Fundamentals of Emergency Management., Emmitsburg, MD: Federal Emergency Management Agency Emergency Management Institute. Available at www.training.fema.gov/EMIWeb/edu/fem.asp or archone.tamu.edu/hrrc/Publications/books/index.html.
- [7] Roorda, J., Van Stiphout, W. A. H. J., Huijsman-Rubingh, R. R. R., Post-disaster health effects: strategies for investigation and data collection. Experiences from the Enschede firework disaster. *Journal of Epidemiology and Community health*, 58, pp. 982-987, 2004.
- [8] Tunstall, S., Tapsell, S., Green, C., Floyd, P., George, C., The health effects of flooding: social research results from England and Wales. *Journal of Water and Health*, 4, pp. 365-380, 2006.
- [9] Zaetta, C., Santonastaso, P., & Favaro, A., Long-term physical and psychological effects of the Vajont disaster. *European Journal of Psychotraumatology*, 2, 2011.
- [10] Boyd, A., Chambers, N., French, S., King, R.A., Shaw, D., Whitehead, A.S., A scoping study of emergency planning and management in health care: What further research is needed? Final report. NIHR Health Services and Delivery Research programme, 2012.
- [11] Boyd, A., Chambers, N., French, S., Shaw, D., King, R., Whitehead, A., Emergency planning and management in health care: priority research topics. *Health Systems*, 3 pp. 83-92, 2014.

- [12] Lindell, M.K., Disaster studies. Lindell, M.K., 'Disaster studies', Sociopedia <http://www.isa-sociology.org/publ/sociopedia-isa/sociopedia-isa-list-of-published-entries.htm>.
- [13] Murray C, Evans D (Eds.), Health Systems Performance Assessment, Debates, Methods and Empiricism, WHO, Geneva, available at: whqlibdoc.who.int/publications/2003/9241562455.pdf?ua=
- [14] Gummesson, E., Qualitative research in management: addressing complexity, context and persona. *Management Decision*, 44(2), pp. 167-179, 2006.
- [15] World Bank, Analyzing the Social Impacts of Disasters, Volume I: Methodology, Retrieved September 8, 2014 from <http://siteresources.worldbank.org/INTEAPREGTOPSOCDEV/Resources/PostDisasterocialAnalysisToolsVolumeI.pdf>
- [16] World Bank, Analyzing the Social Impacts of Disasters, Volume II: Tools Retrieved September 8, 2014 from <http://siteresources.worldbank.org/INTEAPREGTOPSOCDEV/Resources/PostDisasterSocialAnalysisToolsVolumeII.pdf>.
- [17] Joffe, M., & Mindell, J., A framework for the evidence base to support Health Impact Assessment. *Journal of Epidemiology and Community Health*, 56(2), 132-138, 2002.
- [18] Mabry, L., Case study in social research. The Sage handbook of social research methods. SAGE Publications: London, 2008.
- [19] Zelger J., Serielle und parallele Wissensverarbeitung. Die Simulation von Gesprächen durch GABEK. In R. Buber & J. Zelger (Eds.), GABEK II Studienverlag: Innsbruck u.a., pp. 31-91, 2000.
- [20] Verger, P., Aulagnier, M., Schwoebel, V., Lang, Th., French experiences with Health Impact Assessment of disasters, *European Journal of Public Health*, Vol. 17, No. 1, pp. 3-7, 2006.