Health Impacts of Large-Scale Floods: Governmental Decision-Making and Resilience of the Citizens

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15WCDEM = 15th World Congress on Disaster and Emergency Medicine
IPCC = Intergovernmental Panel on Climate Change
TAP = targeted agenda program
WHO = World Health Organization

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Abstract

During the 15th World Congress on Disaster and Emergency Medicine in Amsterdam, May 2007 (15WCDEM), a targeted agenda program (TAP) about the public health aspects of large-scale floods was organized. The main goal of the TAP was the establishment of an overview of issues that would help governmental decision-makers to develop policies to increase the resilience of the citizens during floods. During the meetings, it became clear that citizens have a natural resistance to evacuations. This results in death due to drowning and injuries. Recently, communication and education programs have been developed that may increase awareness that timely evacuation is important and can be life-saving. After a flood, health problems persist over prolonged periods, including increased death rates during the first year after a flood and a higher incidence of chronic illnesses that last for decades after the flood recedes. Population-based resilience (bottom-up) and governmental responsibility (top-down) must be combined to prepare regions for the health impact of evacuations and floods. More research data are needed to become better informed about the health impact and consequences of translocation of health infrastructures after evacuations. A better understanding of the consequences of floods will support governmental decision-making to mitigate the health impact. A top-10 priority action list was formulated.

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Introduction

The topic "Public Health Impacts of Large-Scale Floods" is considered to be relevant to the Ministry of Interior and Kingdom relations of the Netherlands due to an increasing awareness that vital parts of the country are facing serious risks of flooding. Health aspects represent a major problem in case flooding occurs.

Lessons learned from the floods of New Orleans after Hurricane Katrina[1] and the Intergovernmental Panel on Climate Change (IPCC) Third Assessment Report,[2] that indicated a projected increased incidence of floods, also justified attention to this subject. Findings from Hurricane Katrina (2005) illustrated the increasing vulnerability and the health impact of large-scale floods. In New Orleans, thousands of persons and pets were trapped in the flooded area, and >1,100 people were killed, of which 20% were among evacuees outside of the flooded areas. For a long period, the local health system was not capable of dealing with the situation.[1]

The IPCC's Third Assessment Report projected changes in extreme climate events that include increase in winds, tropical cyclones, variability in the Asian summer monsoons, and floods. According to this report, some large-scale climate events have the potential to cause large impacts, especially after the end of the 21st century. Extreme rises in sea-level that would result from widespread deglaciation of Greenland and West Antarctic ice sheets, imply inundation of low-lying areas with greatest effects in river deltas. Other pos-

sible impacts of climate change that affect the risk of floods are more frequent episodes of heavy precipitation.[3] The direct and indirect health effects of floods also are related to an inability to cultivate land, salinization, decreased fresh water availability, migration, and disruption of settlements.

A global analysis by the reinsurance company Munich Re found a tripling in the number of events due to natural hazards during the last 10 years, compared to the number during the 1960s. The global trend of increased population vulnerability is most significant in high-risk areas like coastal zones in developing countries. These areas are poorly equipped to deal with extreme weather conditions, while at the same time, the population concentration in these areas is increasing. Hence, the number of people killed, injured, or made homeless by disasters, and notably floods, increasing rapidly. The World Health Organization (WHO) notes that there is a need to assess vulnerabilities and to identify interventions and adaptive options. Preventive health measures can reduce future adverse health impacts.[3]

Given the above mentioned issues, the following questions were proposed during the targeted agenda program (TAP) on floods during the 15th World Congress on Disaster and Emergency Medicine, Amsterdam, May 2007 (15WCDEM):

1. Which structural and infrastructural health problems can occur after large-scale floods?;
2. Which measures can be taken to prevent and mitigate these problems?;
3. How can these measures be integrated into decision-making?; and
4. What is the responsibility of the government and what is the responsibility of the individual citizen?

Methods

The central theme of 15WCDEM was Preparedness: Knowledge, Training, and Networks. The TAP concept had been introduced to generate interaction between experts and existing networks by using the internet and other forms of communication as an interactive and dynamic tool to channel knowledge.

The responsible policy-makers at the Ministry of Interior and Kingdom Relations (MOI-NL) contacted two national experts on the issue of floods to prepare the TAP Within their existing network, including the EU-Interreg North Sea Regions Chain of Safety Projects (**http://www.chain-ofsafety.com**), they invited other experts to prepare and participate in the TAP. An abstract of the issues was posted on the TAP section of the Congress Website. Prior to and during the Congress, the TAP group defined and discussed the leading questions and produced a top-10 priority action list. During the first day of 15WCDEM, the TAP experts from different backgrounds, including health representatives, policy-makers, engineers, and disaster managers provided their respective visions on the issue during oral presentations. This was followed on the second day by an open discussion with Congress participants that included a first attempt to answer the four questions. On the last day, during an invitation-only session, the TAP group agreed on the best answers to the questions and composed the top-10 priority list based on the answers of the initial questions. The answers and priority list were presented to the delegates during the plenary Closing Ceremony of the Congress.

Results

Expert Views

Epidemiological data on the health effects of floods indicate that most immediate flood deaths are due to drowning and acute trauma. The number of deaths is related to the characteristics of the flood. Limited data indicate that most injuries are mild and occur during self-rescue attempts or while attempting to rescue families and possessions.

However, during the first year after a flood, the mortality rate of the flooded population still may continue to increase up to 50%. In low-income countries, a significant increase of deaths due to diarrhea occurs. Fecal and oral diseases are an important issue in low-income populations with limited access to water and sanitation. Collections of stagnant water can increase the risk for developing malaria. During the post-flood period, anxiety, depression, and increased physical symptoms are found, more common in women. Among children, behavioral changes and increased bedwetting is noted.[5]

The WHO Technical Hazard profile (**http://www.who.int/hac/techguidance/ems/floods/en/index.html**) can be used as a model for planning to cope with the most relevant issues that should be addressed to minimize the health effects of floods. The model includes topics such as flood classifications, factors of vulnerability, morbidity profiles, mortality profiles, needs, mitigation measures, and a flood drowning prevention policy. Other relevant issues to reduce the risk of health impact of floods include land use planning, anti-flood infrastructure, early warning, planning, and coordinated relief response.

Several experts related experiences in their country. In Sri Lanka, the 2004 tsunami initiated a bottom-up training of instructors to plan, communicate, educate, train, and work interactively at a local level. All efforts are aimed for all stakeholders better prepared. The introduction of swimming lessons to children at the local level was a simple remedy to begin to deal with the problem of drowning. Community responsibility and community training in first aid and resuscitation have become the cornerstones of resilience. At the same time, it was considered important to initiate a top-down program to improve the organization of disaster preparedness. Authorities in Sri Lanka expect that a combination of a bottom-up and top-down approach will be the best way to prepare the community for floods and tsunami.

In the United Kingdom, it also has become clear that the interdependencies in modern society increase the impact on the severity of floods. Coordination of multi-agency responses is necessary when the country is struck by coastal, inland, and/or flash flooding. In the UK, there are many doubts that people will leave their homes and evacuate. It is feared that an evacuation may not be as successful as expected due to lack of public awareness. Effective risk communication, by targeting specific audiences, is an

option to improve awareness. Other options to raise public awareness include holding flood fairs and starting awareness campaigns using flyers, leaflets and Websites. Targeting the issue of floods during the education of children has been demonstrated to be effective. The education includes a calendar that engages children to think more about the wider picture of risk and crisis management in an unusual way. It has been shown in the UK that children can be the incubator of an interactive learning process with their family, friends, and the community. The county of Essex has developed a curriculum package for children that has the objective to raise awareness of floods in a wide spectrum of activities. At the same time, political pressure should raise awareness for the risk of floods and the long-term psychosocial effects on the communities.

In the Netherlands, more precisely in the province of Zeeland in 1953, floods caused hundreds of deaths, thousands were injured, and tens of thousands were rendered homeless. The inhabitants of the flooded areas decided to postpone evacuation until the last moment when water already was flooding into their houses. According to Ellemers, in one of the few research reports on floods from that period, the factual appearance of the situation was life-threatening, but the inhabitants denied this for a long time and stayed in their houses.[6] The economic devastation was enormous. Since the 1953 flood, water is considered to be the natural enemy and the creation of a massive water defense system, the Deltaworks, was initiated. Although the social and economic life behind dikes and in polders is safe, many people still struggle with their personal experiences, notably the old and lonely. Family doctors in the Zeeland village of Stavenisse mention that in about 50% of the patients with chronic diseases, the complaints go back until the 1953 flood.[5] Although no epidemiological research has been initiated after the 1953 floods, there is a general assumption that the inhabitants of Zeeland have a collective trauma to floods and the sea. For this reason, policy proposals are being developed to change public opinion into a more water friendly opinion. The policy proposals also include the awareness of the risk of floods and refer to more resilience to the effects in case a flood occurs.

Although the 1953 flood has been the largest disaster to strike the Netherlands, the system-based approach of crisis management and disaster relief in the Netherlands has a generic, all-hazard approach. Important aspects of the generic approach are: (1) full decentralization from the national administration to the local authorities; (2) the philosophy of mutual assistance between communities; and (3) the application of the concept of the safety chain (proaction, prevention, preparation, response, recovery). The concept of the safety chain allows a consistent approach to link all phases of mitigation to all hazards. A well-prepared risk assessment of the health aspects is a key issue for good preparation. This also refers to floods.

A recent immediate threat of inundation of the Betuwe, a lowland part of the Netherlands, was an illustrative case on which several important observations have been made. The preventive evacuation of 220,000 persons from the area only was possible after a massive communication offensive. The evacuation demonstrated, again, that people wait until the last moment to evacuate. It also was demonstrated that the resilience of the public was much better than expected. Many persons who had to evacuate found quarters with family or friends outside of the potentially affected area. Practically all the livestock was evacuated to safe areas by the farmers themselves. One hospital had to be evacuated, and this took place in a well-coordinated way without major negative effects on the patient population. A larger problem was the evacuation of nursing homes, elderly homes, and the sick people who were alone at home. Planning for the allocation of the old, sick, and disabled people was poor, while most of all, they are depending fully on the support of the authorities. The complexity of the situation needed a coordinated, multi-agency response. The evacuation also put into practice the harsh dilemma for most of the rescue workers and other staff involved who had to evacuate their own family and possessions while they had crucial roles to fulfill.

Expert Results

Answers to the four TAP questions included:

1. Which structural and infrastructural health problems can occur after large-scale floods?

There is little research available about the effects of floods on health and health infrastructure. Most of the identified flood deaths are due to drowning and acute trauma. Mortality and morbidity is increased in the years and decades after a flood. Special attention is needed for the long-term healthcare aspects and psychosocial effects for those who have returned from evacuation. No data or models are available to assess the structural and infrastructural health problems.

2. Which measures can be taken to prevent and mitigate these problems?

Planning, warning, resilience, and coordination of relief responses are the basis for prevention and mitigation. Evacuation requires careful planning and should take into account that it is difficult to convince people to evacuate. Awareness, community responsibility, and education and training of the general community in first aid and resuscitation are the cornerstones of resilience. Educational programs on these issues have been initiated and have shown good effects. It is important to use existing social structures, involve all inhabitants in preparation, raise awareness, and develop coherence in mitigation plans.[7]

3. How can these measures be integrated into decision-making?

The cornerstone of regional policies should be resilience of the population and preparation on the risk of floods. Structured and multidisciplinary planning of all the shackles in the safety chain will prepare organizations to act and decision-makers to react. The growing risks of the health effects of floods should have full attention of policy-makers and should be placed high on the political agenda.

4. What is the responsibility of the government and what is the responsibility of the individual citizen?

Health care is a primary need and should be assured by the authorities. There is a moral appeal to each individual to be

aware of risks and as much as possible to be prepared for the effects of floods. It is the obligation of the government to facilitate the individual needs, but also to organize the collective mitigation of the effects. Scientists are the third party with responsibility and should support with research and knowledge those actions that must be taken by the population and the government.[7]

Top-10 Priority Action List

The expert views, expert results, and the later discussion resulted in a priority action list with recommendations for further research. The list is largely based on the eye-catching observations that grave disruptions of societies occur during evacuation and re-evacuation. Therefore, societies are very vulnerable both during the mitigation and recovery phases of a flood. The formulation of the top-10 priority action list also recognizes the large number of patients in the aftermath of a flood and the lack of consistent research on the health implications. This list is as follows:

1. Raise public awareness in a holistic and all-hazards approach that is aimed especially at children, the government, and the business society;
2. Identify the vulnerable target groups and teach them how to work together and create a state of readiness;
3. Develop behavioral perspectives for the population, depending on the locally relevant flood scenario (flash, river, coast);
4. Develop and facilitate resilience strategies for the population;
5. In planning the use of land, it also should be considered whether the land is prone to floods;
6. Initiate hazard and vulnerability analyses for health facilities and health systems;
7. Maximize the use of social structures and involve the population in preparation;
8. Stimulate cooperation between governmental organizations, non-governmental organizations, and public organizations such as lifesavers and health professionals;
9. Identify the health aspects of (re)evacuation, including mental health; and
10. Consider long-term psychosocial aspects.

Discussion

Exposures to projected climate changes are likely to affect the health status of millions of people, particularly those with low adaptive capacities. In Europe, inland flash floods and coastal floods from storms and high waters are anticipated will occur more frequently. Increased morbidity and mortality is expected. This will result in a considerably higher burden on health services.[3]

Adequate new policies on how to deal with the health aspects of floods should be based on lessons learned in the past. These policies must lead to an effective answer to questions such as: Which measures can be taken to mitigate the expected health problems? The complexity and scale of the problems requires a joint process. During this process, searches for new systems of checks and balances between the public domain and the private domains are needed. Scientists should participate in heterogeneous networks to allow the inclusion of scientific data into a more extended process of knowledge production that is required to solve the issues. Research gaps that must be filled include further modeling of relationships between health and floods.

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