

Brief Report

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Does Monsoon Itself Cause Health Risks? Lessons From the Flash Flood of Imamzadeh Davood, Iran 2022

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Abstract

During the summer of 2022, several regions worldwide, including Iran, were subjected to intense monsoon rains, resulting in significant adverse impacts on the health, economy, and social well-being of affected populations. However, by focusing on adaptation and resilience measures, not only could the negative consequences of this phenomenon be mitigated, but as evidenced by other countries, the opportunity presented by rainwater could be utilized to promote development, health, and socioeconomic welfare in these areas. This concise report aims to explore the lessons learned from this phenomenon, including its strengths and weaknesses.

A monsoon is a significant wind system that changes direction seasonally, blowing for around 6 months from the northeast and 6 months from the southwest.¹ The main cause of monsoon formation is the annual temperature variation in large land areas compared to the surface of nearby oceans.² Monsoon climate, characterized by a dramatic seasonal shift in the direction of an area's prevailing winds, produces a marked change in rainfall, resulting in sizable annual rainfall of more than 1.5 m (5 ft) in many places.³ During summer monsoons, heavy rainfall can cause powerful floods that may result in loss of life, damage to buildings, and leave populations vulnerable to hazards. However, the primary health risks during the summer monsoon are diseases such as cholera, dengue, chikungunya, malaria, and gastrointestinal and eye infections⁴; although in India, adapting to the summer monsoon has been shown to promote health, social welfare, and the economy.⁵

Brief Report

Starting from August 6, 2022, a phenomenon characterized by sudden and heavy rainfall, severe lightning, and dust storms became active in various regions of Iran, resulting in significant loss of life and property.² Recent monsoon rains of summer 2022 until the middle of August almost caused the death of more than 90 people⁶ and affected approximately 136 cities, 958 districts, 133 counties, and 1344 villages across Iran.⁷ Among the areas most severely impacted by this phenomenon was the Imamzadeh Davood recreational pilgrimage site located in the northwest of Tehran, Iran (latitude and longitude: 35.87677, 51.33744). This area has a seasonal river that passes through the middle of houses and Imamzadeh by a concrete waterway (Figure 1).

On August 6, 2022, at 1:30 PM, there was a heavy rain that lasted for 20 minutes, followed by a massive flood in the Imamzadeh Davood area. The flood originated from the north side of Imamzadeh place and the old bazaar, passing through restaurants and various shops from 2 locations—the main entrance of Imamzadeh and the passage of the water channel under the Imamzadeh building. The flood destroyed the roof of the river, which was located under Imamzadeh, and entered the courtyard of Imamzadeh, causing significant human injuries and financial damage. Unfortunately, 24 people lost their lives in this area (Figure 2).

Official reports, field evidence, and documents indicated that some of the causes of these tragic deaths following the 20 minutes of heavy rain were as follows:

- Failure to learn from previous events. Historical records reveal that in 1954, a similar sudden rainfall and ensuing flood transpired at the same location, resulting in the complete devastation of Imamzadeh and claiming the lives of over 500 individuals within the courtyard and over 2000 people along the flood path (Supplementary 1: Figure 1). One crucial aspect of emergency and disaster management is the use of lessons learned from past incidents. If the lessons learned from the previous event had been taken seriously at



Figure 1. Imamzadeh Davood area and its seasonal river.

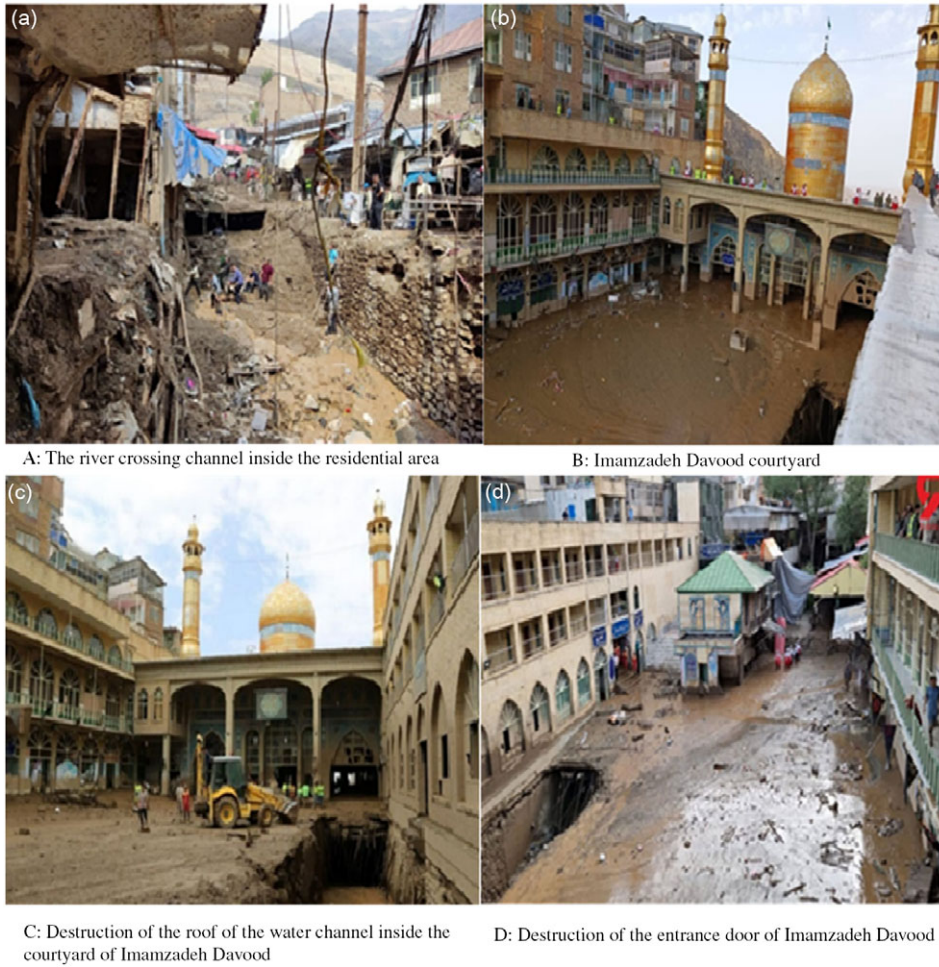


Figure 2. Imamzadeh Davood after the flash flood (A, B, C, D).

this location and implemented to reduce the risk of disasters, the health, economic, and social consequences of this incident may have been less severe.

- Inadequacy of certain aspects of the emergency and disaster management program. Despite having accurate weather forecasts predicting the occurrence of sudden monsoon rains, weaknesses in various processes of the disaster management program, including some aspects of the early warning system and prompt evacuation of people at risk, were evident. In this incident, there was a lack of proper notification to those at risk, failure to evacuate on time, and failure to observe traffic restrictions in high-risk areas. An effective early warning system is critical for disaster management. According to the World Health Organization, the first component of the response plan is to establish a comprehensive early warning system that operates simultaneously to notify those at risk before exposure to the hazard. The system comprises 4 parts: risk knowledge, monitoring and warning, communication, which is the core of the system, and response capability. It is essential to note that the notifications sent by the early warning system should be clear, understandable, and disseminated to all individuals who are at risk.
- Lack of proper emergencies and disaster risk perception and insufficient investment in reducing the risk of incidents. As previously noted, the physiography of this area indicates that it is prone to repeated floods, and this region is considered high risk. Despite the historical records of floods in this region and its high vulnerability, there appears to be inadequate risk perception among both the exposed population and regional authorities to prevent disasters and minimize the damage caused by floods. Moreover, scientific and practical investments to mitigate the impact of floods in this region have been insufficient, based on the historical records of floods and the occurrence of new climate events. It is crucial to prioritize scientific and practical investments based on evidence to reduce the risk and minimize the damage caused by floods in this region.
- Lack of respect for the waterway boundary by human intervention and unauthorized construction in the river.⁸ As evident in the descriptions and pictures, the disregard for the boundary of the river and unauthorized construction for personal gain was one of the primary causes of this incident.
- Inadequacy of watershed and aquifer management plans to manage the type and intensity of risks in the region.⁹ Evidence and reports suggest that several flood control projects have been implemented in the past in the watershed and seasonal river of this region, which were successful in controlling a significant volume of floods. However, the tragic outcomes of this flood indicate that this level of activity was not effective and needs to be reviewed and strengthened in light of the type of hazards, vulnerable points and factors, and the level of risk posed by regional hazards. It is crucial to develop and implement effective watershed and aquifer management plans that consider the intensity and type of risks in the region to minimize the damage caused by floods.
- The last contributing factor was the seasonal river's capacity and route not corresponding to the risks in the region, including all risks and consequences.¹⁰ One of the other causes of this incident is the blockage of the seasonal river in this area with the destroyed remains of some stone-mortar and gabion dams of the seasonal river, the flow of mountain erosion remnants in the water path, and a car that entered the

flood from the upper reaches of the river. These factors caused an obstacle in the way of water flow, rising water, destruction of water channel, and, ultimately, water entering the Imamzadeh courtyard and surrounding buildings.

Discussion

The evidence from this incident underscores the importance of scientific, accurate, and operational planning to reduce the risks of disasters in different regions. Failure to do so can lead to health, economic, and social risks, outweighing the potential benefits of adapting to these risks. The monsoon phenomenon that occurred in Iran during the hottest, driest, and rainless month of the year added more than 20 mm of water to the country's overall level. However, the lack of learning from previous risks, weaknesses in parts of the management process, inadequate emergencies and disaster risk perception, insufficient investment in reducing the risk of incidents, human interventions in the waterway, inadequate watershed and aquifer management plans, and the seasonal river's capacity and route not matching the hazards of the region resulted in the destructive effects of this phenomenon overshadowing the positive aspects of the rainfall in the semi-hot and dry year in Iran.

To manage such incidents effectively, the following items and suggestions should be considered to reduce problems in future incidents:

1. Changing the disaster management approach from a response-oriented approach to a mitigation approach by improving the region's adaptability and resilience to hazards
2. Learning from previous incidents refers to data collection, analysis, dissemination, and application of learning experiences from incidents
3. Promoting and developing early warning systems for various risks, and improving the awareness and performance of the disaster management system
4. Preparing high-risk points maps of monsoon floods and assessing the risk of these areas and practice
5. Promoting interdepartmental cooperation for the timely evacuation of exposed people immediately after forecasting and sending a warning and communicating the prohibiting traffic rules to these areas
6. Installing early warning systems in places with a high risk of flooding for quick notification to exposed people
7. Improving the attitude, awareness, and performance of people exposed to risks
8. Establishing laws to protect the privacy of rivers and waterways, and a more serious follow-up of related laws and necessary legal action against violators
9. Reassessing the strengths and weaknesses of watershed management and aquifer management plans with the intensity and type of risks in the region, and strengthening the strengths and optimizing the weaknesses
10. Cleaning the waterways and seasonal rivers and improving and enlarging the entrances of bridges and culverts according to old and new vulnerabilities
11. Insuring infrastructures and exposed areas

Conclusion

In conclusion, learning from disasters is essential for disaster risk reduction and building resilience in exposed areas. Lessons learned from the occurrence of any hazard that becomes a disaster can be

used not only for better planning to reduce the risk of disasters in that area but also as a guiding document for the prevention of similar hazards and sustainable development in other exposed areas. Policy-makers, urban planners, and disaster managers can take full advantage of such lessons learned in future urban planning to perform disaster risk reduction in exposed areas and enhance resilience against similar risks in the future. It is crucial to prioritize disaster risk reduction and resilience-building measures to ensure that we are better prepared for future incidents and minimize the impact of disasters on health, economic, and social activities.

Supplementary material. The supplementary material for this article can be found at <https://doi.org/10.1017/dmp.2023.104>

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