

People's Response to Disaster: A Population Based Study of the Victims of 2018 Flood in Kerala, South India

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Abstract

Background: Natural disasters cause much hardship and suffering, loss of property, and increased morbidity and mortality amongst those affected. Timely and effective response for relief and rescue services go a long way in mitigating these consequences. **Material and Methods:** This population-based cross-sectional, descriptive study conducted in the immediate aftermath of the catastrophic flood that occurred in Kerala, South India, in 2018, documents the experiences of the victims, the community's preparedness, and response to the disaster. **Results:** Flood waters reached levels of over four feet within the premises of 55% of the houses and nearly 97% had water flooding inside their homes. More than 93% of the households were evacuated to safer locations and relief camps. The elderly and those with chronic illnesses were the worst sufferers, unable to access medical aid. Many families (62%) received help from neighbors. **Conclusion:** However, the loss of lives was minimal, and could be attributed to the immediate response of the local community in rescue and relief work. This experience underscores the vital importance of the local community as first responders, and their preparedness for disasters.

Keywords: Disaster preparedness, first responders, flood, natural disaster, rescue and relief

INTRODUCTION

Floods are among the most significant "natural disasters" in terms of the number of persons affected^[1] and remain one of the main challenges faced by a large number of people in developing countries. They not only cause high mortality and suffering, but also damage the local economy and thwart developmental achievements.^[2] The risk that a flooding event will be a disaster is a function of three factors: the hazard associated with the flood; the human and natural systems exposed to the floodwaters; and the vulnerability of these systems to flooding.^[3] With the rapid development of urbanization in recent years, risk of floods have become severe^[4] and their impact is expected to grow in future due to the added effects of climate change.^[5,6]

Severe floods are a common cause of displacements, homelessness, and epidemics in the low-income countries of Asia and Africa.^[7-10] Health effects of floods may include physical injury, worsening of existing chronic illnesses, infections such as Leptospirosis as well as psychological problems such as stress, depression, and post-traumatic stress

disorders, all of which have gained attention in recent years.^[11] Scarcity of food, water, shelter, and health care during the crisis further aggravates the problem.^[12] The environment also suffers as the natural balance of the ecosystem is disrupted.^[13] Chemicals and other hazardous substances end up in water and eventually contaminate the water bodies; many natural habitats are destroyed, killing many animals, while insects and snakes venture out, seeking newer areas, putting people at higher risk.^[13] This demands preparedness for flood disasters every year.

The heavy monsoon of 2018 in India caused floods in the states of Kerala, Maharashtra, Gujarat, Karnataka, West Bengal, Assam, Bihar, and Uttar Pradesh. Kerala is a small coastal state in South India, sharing its border with the Arabian Sea. The

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pride of Kerala is its gorgeous beaches, enchanting waterfalls, beautiful lagoons, and many meandering rivers, which in turn puts the state at an increased risk of floods every year. Kerala also has many dams, and hydroelectric power stations are the major source of power supply within the state. During monsoons, there is plenty of rain to fill these natural as well as man-made reservoirs, exposing the vulnerability of the system to flooding.

The Kuttanad Taluk in the Alappuzha District of Kerala, known as the “The Rice Bowl of Kerala,” with a population of 2.5 lakhs, is an area with the lowest altitude in India and one of the few places in the world where farming is carried out 4 to 10 feet (<https://en.wikipedia.org/wiki/Kuttanad>) below the sea level. Consequently, this area is most susceptible and vulnerable to flooding during the monsoons and experiences some level of flooding every year. Annual flooding of the premises and the houses being a common phenomenon, the residents are accustomed to low levels of flooding as long as transportation and other facilities of daily life are not disrupted. This area was one among those which were severely affected by the flood of 2018.

While there is ample research identifying the health effects of floods and its characteristics,^[14,15] little is known about the immediate responses and experiences of the 2018 flood victims when the flood waters reached their doorsteps, during the biggest ever flood that Kerala had ever witnessed in a century.

METHODS

This cross-sectional descriptive study was conducted in Kuttanad Taluk in Alappuzha district of Kerala. Approval of the Institutional Ethics Committee was obtained prior to the commencement of the study, and written informed consent was obtained from every participant.

Kuttanad Taluk has 12 panchayats. In our study, the first-stage cluster sampling was dispensed by taking up all 12 panchayat areas for the survey. Hence, these 12 panchayat areas formed the 12 clusters for the survey. For the second stage of sampling, we obtained the houses for the survey through stratified cluster sampling. Each panchayat area was divided into two strata according to ease of accessibility to the localities: “difficult to access” and “easier to access,” based on the water level in the approach roads, availability of canoes, etc. Fifteen households from “difficult to access” and 15 households from “easier to access” areas were surveyed randomly giving a total of 30 houses from each cluster. We used a modified Community Assessment for Public Health Emergency Response method to conduct the survey.

The head of the household or the eldest capable member of the household present at the time of the survey was taken as the respondent. Information on basic demographic details, 2018 flood details, its impact, and the households' immediate response to the flood and its impact were collected from November, 2018 to March, 2019. The respondents were classified as *capable* members if they were able to plan and

execute decisions related to saving themselves and their belongings, and *dependents* if they relied on others to save themselves from the flood.

The required information was collected by conducting a face-to-face interview, using an unstructured open-ended questionnaire. The questionnaire was translated into Malayalam (local language) and back-translated into English by an independent person proficient in both languages to ensure accuracy.

Data was entered in Excel and statistical analysis was performed using the statistical software SPSS v. 21

RESULTS

The study covered 364 households, which consisted of 1594 family members. Majority of the respondents were males (69.2%). Majority (70.3%) (256 households) had four–six family members, 23.6% (86 households) had only one–three family members, while 6.1% (22 households) had more than six family members [Table 1].

Nearly, half (48.7%) of the participants had a monthly income below Rs 10,000. Nearly, one-third (31.3%) of the households had monthly income between Rs 10,000 and 20,000 [Table 1].

We compared the water level of 2018 floods to the regular floods of the previous years. Households where water level reached >four feet in their premises was 1.4% (five houses) during the previous year's flood, it reached >four feet in 54.7% households during the 2018 flood. Nearly, 97% had water flooding inside their homes and more than 60% of the households had a water level above two feet within their homes in the 2018 flood [Figure 1].

More than 93.4% of the households had to evacuate their homes as the flood water reached dangerous levels, endangering their

Table 1: Profile of the households (n=364)

Household Profile	Frequency (%)
No. of Family Members	
1-3	86 (23.6)
4-6	256 (70.3)
>6	22 (6.1)
No. of capable members	
None	10 (2.7)
1-2	97 (26.7)
3-4	208 (57.1)
>6	49 (13.5)
No. of dependents	
None	140 (38.5)
1-2	185 (50.8)
>6	39 (10.7)
Monthly Income (Rs)	
Upto 5000	97 (26.7)
5001-10000	79 (21.7)
10001-20000	114 (31.3)
>20000	74 (20.3)

lives. Approximately, 5% of the houses were unaffected by flood, but they also panicked due to heavy water logging in the approach roads that impeded supplies of essential commodities, including power supply, anxiety over infants and elderly population over their medical needs, fear of losing certificates and identity cards, and the lack of usable toilets.

About 65% of the residents took shelter in their relatives' houses, 23% shifted to camps, and 7% moved to the terraces of their houses and braved the flood [Figure 2]. We also observed that, above 10.9% among the evacuated had more than four feet of water level, 47.1% had between two and four feet of water level, 16.2% had one–two feet of water level, 24.7% had below one feet of water level, and 1.2% had no water in their houses.

Nearly, half (48.4%) of the households reported that they were informed of the severity of the flood, through village offices, village panchayats, and police stations. Also, they were instructed to evacuate the area at the earliest, keeping only their most important valuables and documents with them. The power supply was shut down by Kerala State Electricity Board as the substations were also flooded and, therefore, media messages did not reach the entire region for three weeks.

Food scarcity was reported by 28% of the respondents and unavailability of drinking water by 31% [Table 2]. Majority of the participants (76%) thought that they had managed to keep their belongings at a safer height within their homes, but among them, 55% lost their belongings as the water level rose to unprecedented and unexpected heights.

Time spent in rescue activity and translocating to safer zones varied, depending on the accessibility of the household to the main roads. Time taken was more than five hours in 40% of the households [Table 2]. During this process, 62.1% had to find some means of transportation by themselves, 27.2% received help from either their friends, neighbors, or relatives, and 10.7% received support from the government

and non-governmental organizations (NGOs). In regular flood situations, government agencies evacuate the people to relief camps put up in nearby schools or halls.

Majority of the families (62%) shifted from their flooded houses by their own efforts, even by taking risks, 33% shifted with the help of their friends, relatives, neighbors, NGOs, and volunteers, and 4.4% shifted with the help of government organizations. Members of many families helped other families (62%) in evacuation, providing food (30%) and accommodation (2.5%), by safely relocating their domestic animals or moving their valuable properties and documents to safer places (56.6%). However, the sudden and unexpected rapidity of the rising level of the flood water in the present flood took everyone by surprise.

DISCUSSION

The 2018 flash flood in Kerala was one of a kind that our generation had ever witnessed, caused by the heaviest monsoon in a century, about 116% more than the usual rainfall, which led to the displacement of more than one million people. Due to the heavy continuous downpour, the dams in the state were filled above their maximum capacities in a short time period. This prompted the authorities to open the shutters of the dams due to fear of exceeding their holding capacity. The sudden release of the large quantities of water from all the dams, compounded by heavy rainfall, resulted in a sudden rise in water level affecting almost the entire state, especially the low-lying areas of Kuttanad.^[16] This also caused landslides in the hilly regions of the state, causing much loss of life and property. Water covered the rooftops of single-storied houses, even reaching up to double-storied heights in certain regions. Aid agencies and government groups had set up more than 4,000 relief camps and rescue personnel made their way to submerged villages in helicopters and fishermen boats, to provide supplies to stranded people on rooftops and evacuating those who were helpless. Young men offered their backs for the elderly, children, and pregnant women to walk over to get out of the rescue boats.

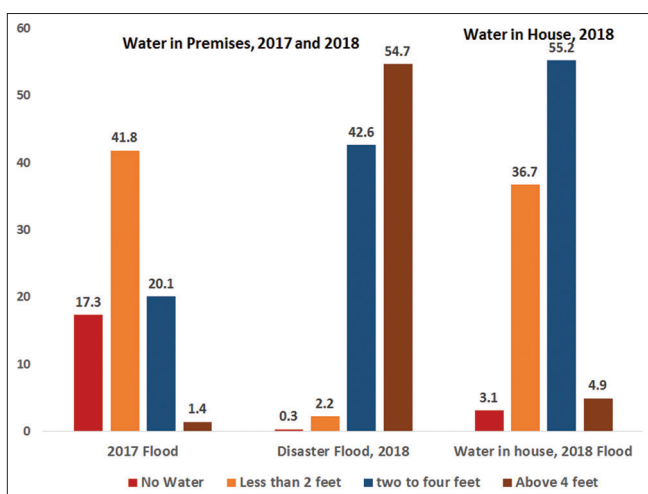


Figure 1: Comparison of water-level during the 2017 flood and the 2018 flood

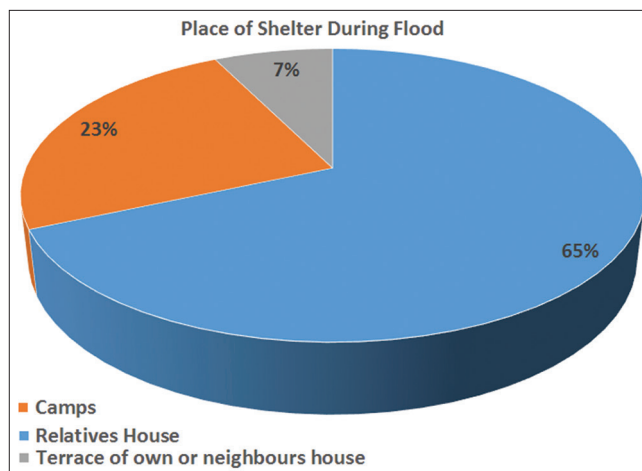


Figure 2: Shelter sought

Table 2: Peoples' response to the flood at their door step

People's Response	Number (Percentage)
No. of families shifted	340 (93.4)
No. of families who panicked thinking that the flood will become uncontrollable and would engulf them	287 (78.8)
No. of families who thought that after the floods, they would be able to resume their normal life	241 (66.2)
No. of families who received a warning from the government to shift to a safer place	176 (48.4)
No. of families who experienced food scarcity	102 (28)
Number of families who had drinking water scarcity.	114 (31.3)
Number of families who tried to keep their belongings in a safer place.	277 (76.1)
Number of families who lost their belongings, which they had moved to what they thought was a safe place.	201 (55.2)
Number of families who tried to move their livestock to a safer place.	60 (37.5)
Number of families who lost their livestock in spite of trying to move them to a safer place.	25 (41.7)
At the time of crisis, time taken to be rescued to a safer place:	
0-1 h	88 (26.9)
2-4 h	105 (32.1)
5-9 h	63 (19.1)
>9 h	71 (21.7)
Who assisted the family to shift:	
Self	226 (62.1%)
Neighbors/Friends/Relatives	99 (27.2%)
Government/Volunteers/NGOs	39 (10.7%)
Respondents' role in rescue mission:	
Shifting/Lifting	206 (56.6%)
Transport	11 (3%)
Accommodation	9 (2.5%)
Providing food/grocery	109 (29.9%)

The 2018 floods wreaked havoc in an unprecedented measure, causing great damage to the state of Kerala.

DISRUPTION OF COMMUNICATION

To reduce the danger of electrocution, the power supply was disconnected. This caused people to lose communication through mobile phones. Televisions were off and newspaper supply was impeded, so people lost all communication facilities.

Evacuation to a safer zone was a mandate, not a choice. An evacuation "of epic proportions" was carried out, with 95 percent of the population from Kuttanad Taluk shifted to safer locations. "The concerted efforts of NGOs, the police, Fire and Rescue Services, Navy, Air Force, Army, fishermen, the public and government departments, enabled the successful evacuation of people. Only people who did not wish to relocate to camps remained."^[17] However, during this flood, only 16 deaths were reported in Kuttanad region from all 12 panchayats, while 483 deaths occurred all over Kerala. In Uttar Pradesh, 300,000 people were affected out of which 204 died in the floods (68/100,000 deaths); in West Bengal, 227,000 people were affected out of which 195 died (85.9/100,000 deaths); and in Karnataka, 350,000 people were affected out of which 161 died (46/100,000 deaths). In Kerala, 5,400,000 people were affected out of which 483 people died (8.9/100,000 deaths) (<https://timesofindia.indiatimes.com/india/993-deaths-due-to-floods-in-this-years-monsoon-still-counting/articleshow/65555438.cms>). Out of all affected states, the

largest number of people affected by the flood was in Kerala, yet the mortality was the lowest here. This could be due to the active and timely intervention by the people, government, and local organizations in the relief and rescue measures.

Family members

We see that 70% of the households had four–six members, comprising vulnerable individuals such as the elderly, children, and pregnant women. In some houses, the presence of a sick or bedridden individual added to the problem. Many people who were on treatment for chronic diseases such as diabetes mellitus and hypertension, lost their medications in the floods and access to health care was also disrupted. Transportation was a major issue as it took several hours to relocate all people from even a small area.

Income

Approximately, 50% of the households had a monthly income of up to Rs 10,000 and only 20% had a monthly income above Rs 20,000. The people of this region subsist mainly on their cultivation and animal products. However, the floods destroyed everything and left the people with no income for many days.

Comparison of water level compared to previous years

When compared to the water levels of the previous years, the 2018 flood was a nightmare for many. More than 97% of the families had water inside their homes, 60% of them even had more than two feet of water in their homes. While 17% did not have their premises flooded during the previous year's flood, the 2018 flood spared only one respondent's house. With over

two feet of water level within the houses, submerging the septic tanks outside, it became a near impossibility to even answer the nature's call. Back spilling of sewage was also seen in some houses and their premises.

Immediate responses

Panic: The 2018 floods came all at once and within a matter of few hours, the roads were inundated making it impossible to travel via cars and two-wheelers. The people were stranded, with small roads completely flooded, restricting access to main roads. Nearly, 80% of the people thought that the flood would engulf them completely, however, 60% hoped that if they survived the event, they could return to their homes and life would be back to normal once the crisis was over.

Timely intimation regarding the crisis: People reported that they were not intimated on time about the impending disaster nor the opening of dams. Nearly, half of the respondents said that they were intimated at some point of time through police and panchayat offices, regarding the need to evacuate and to ensure the safety of their households. Due to the lack of power supply, communication via social media was also severed, which added to the fear and panic among the people.

Evacuation to a safer place: Majority of the respondent's households (65%) moved to the homes of their relatives, while 17% moved to the Flood Relief Camps set up all across the district. A few of them decided to shift to the rooftops of their own houses. People did not foresee that the flood could even submerge the rooftops and it added to the burden of rescue operations as some of them were initially unwilling to move out of their houses.

Safety of belongings: Majority of the people (70%) thought that they had managed to keep their belongings safe, at higher places within their homes, but as the water level exceeded their expectations, they lost their precious documents and other valuables. Nearly, one-third of the people did not get the opportunity to keep their essential documents and belongings safe as there was no electricity in the homes and people were already wading through knee/hip-deep water in their homes. Many found it difficult to identify a place at home to keep such documents and valuables, where water would not reach. Many lost their belongings, property documents, degree certificates, school books, and other valuables. Also, the plight of the domestic animals was miserable. Some people forced the cattle to move up to their rooftops. Many of them were left in their cages and cattle sheds at the mercy of the floods.

Transportation and time taken to evacuate: Since the road transportation was completely blocked, experienced oarsmen from the coastal areas rushed in with their fishing boats for the purpose of evacuation. Individuals with lorries also joined the rescue operations. On an average, families took over five hours to be safely evacuated from areas with poor accessibility. However, one unique experience in 2018 flood was the immediate response of the local people to rescue the stranded residents. The local community's spontaneous, dedicated,

immediate, and enthusiastic response made all the difference in saving a large number of lives and providing relief and provisions to the stranded people, thereby preventing many deaths. The first responders were from within the community. The people of Kuttanad showed an exemplary community preparedness and response.

CONCLUSION

The present study, conducted in the aftermath of the flood of 2018 that followed a heavy monsoon in Kerala, investigated the experiences and responses of the residents of an area that was most severely affected by the flood. It caused suffering and loss to those affected, particularly, the elderly and those with chronic illnesses. People were unable to access medical aid and daily essentials as their homes were flooded with water submerging the entire ground floor in many places. They left their homes and belongings and shifted to safer places and relief camps, with the assistance of the local community, NGOs, and governmental rescue and relief teams.

However, the experience in Kerala showed that the local community responded immediately for relief and rescue work, and this resulted in timely help to the affected and stranded households, saving many lives. The official government response was quick due to a District Disaster Response Preparedness Protocol in place, to initiate and carry out the rescue and relief work. However, the local community response was timely and immediate, of immense importance in saving lives and providing early relief, and the main reason for the very low mortality in this area due to the event.

This study underscores the vital importance of local community preparedness for disasters, particularly in areas that are prone to such disasters. It also underscores the need for rapid response preparedness on the part of the government at the local/district/state level. Since, it is the local community that is the first responder, efforts are required to strengthen the capacity of the local community to respond to such events.

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Role of authors

1. Pramod Thomas conceptualized the study, prepared the protocol, collected the data, entered and analyzed the data, reviewed the literature and prepared the manuscript
2. Sangeetha Merrin Varghese reviewed the literature and contributed to the manuscript
3. Anoop Ivan Benjamin conceptualized the study, modified the protocol, reviewed the literature, and edited the manuscript.

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Conflicts of interest

There are no conflicts of interest.

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