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Factors Influenced Household's Choice of Flood Adaptation Strategy in Jammu and Kashmir

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ABSTRACT
The study sought to investigate the coping strategies used by households in Jammu and Kashmir and their awareness of and capacity to address flood risks. Three hundred fifty families were randomly selected from the five villages that comprised the sample for research. Findings from this study highlight the importance of education in disaster reduction efforts. The research also discovered that locals-only considered using conventional, time-based mitigation measures and preventative initiatives while disregarding the need to adapt new efforts. Further, the study indicated that gender has minimal impact on the factors a household considers when deciding on flood adaptation tactics. Development requires the implementation of comprehensive disaster policies that take into account local conditions and potential hazards. This can include measures such as spatial planning to ensure that buildings and infrastructure are located in safe areas, house building codes to ensure that buildings are constructed to withstand potential hazards, and the development of resilient infrastructure to potential disasters.
Keywords: *flood mitigation, risk reduction, climate change, natural disaster, Jammu and Kashmir*

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INTRODUCTION

Throughout the dawn of human existence on earth, people have witnessed natural calamities such as drought, floods, earthquakes, landslides, and cyclones. Floods are one of the most hazardous natural disasters since they may devastate an individual's life and their nation's economy, leading to a high social risk for society. During the previous two decades, natural catastrophes have affected an annual average of 217 million people across Asia, according to the United Nations Office for Disaster Risk Reduction (UNDRR). Millions of people worldwide are affected by floods yearly, making them one of the most frequent and devastating natural catastrophes [1].

Higher flood intensities have been experienced in south Asian countries over the past few decades, with India, Bangladesh, Pakistan, and China being the most adversely affected [2]. Inadequate management of floods and poor infrastructure contribute to increased susceptibility to these natural calamities. The selfishness of humans, which caused the riverbanks to be infringed upon, is an example of an anthropogenic component. On the other hand, climate change and environmental hazards, particularly in developing nations, increase the probability of flooding [3].

At the Third United Nations International Conference on Disaster Risk Reduction, which took place in Sendai, Japan, on March 18-20, 2015, the Sendai Framework for Disaster Risk Reduction 2015-2030 was approved for implementation [4]. It is a voluntary, non-binding agreement for 15 years that describes a comprehensive strategy for controlling disaster risk. The overarching goal of the deal is to lessen the impact of natural catastrophes on individuals, communities, and countries. The targeted goals are, aiming for a reduced average worldwide death toll per 100,000 people in 2020-2030 compared to 2005-2015. This goal aims to reduce global catastrophe mortality by the year 2030 significantly [5]. Significantly cut down on the number of individuals worldwide who are afflicted by the disease by the year 2030, with the goal of lowering the average global figure per 100,000 people in the decade 2020-2030 compared to 2005-2015. To lessen the proportion of global GDP lost due to natural disasters by the year 2030. By bolstering the resilience of these essential institutions, we can drastically reduce the impact of disasters on our ability to provide essential services like healthcare and education. Increase international aid to

developing nations by a significant amount by providing substantial, long-term funding to supplement national efforts to put this framework into effect by 2030.

Indian Scenario

Achieving these targets, India has actively supported and implemented the Sendai Framework for Disaster Risk Reduction since its adoption in 2015. With the growing threat posed by climate change and other factors, India has acknowledged the value of disaster risk reduction to mitigate the effects of these catastrophes. India has taken many actions at the national, state, and municipal levels to facilitate the adoption of the Sendai Framework [6]. Among these steps are: Creating an NDMP that reflects the country's commitment to reducing disaster risks and responding to them, as the Sendai framework states. Creating a new government agency, the National Disaster Management Authority (NDMA), responsible for coordinating and monitoring disaster relief activities nationwide [7]. The nation is enhancing its early warning systems by installing Doppler weather radars, automated weather stations, and flood forecasting systems.

Further the government is improving disaster preparedness and response capacities by establishing state-level Disaster Response Forces (DRFs) and the National Disaster Response Force (NDRF) and enhancing community-level preparedness and resilience through awareness-raising campaigns, capacity-building initiatives, and the implementation of community-based disaster risk reduction programs and promoting research and development in disaster risk reduction through collaborations with academic institutions and research organizations [8]. Overall, India's response to the Sendai Framework for Disaster Risk Reduction has been proactive and comprehensive, with a strong focus on building disaster resilience at all levels of society.

Despite India's efforts to implement the Sendai Framework and improve disaster risk reduction, the country still faces natural disaster threats like floods yearly [9]. This is partly due to the country's geographic location and topography, which make it particularly vulnerable to natural disasters. India is in a region prone to cyclones, earthquakes, floods, landslides, and other natural disasters [10]. The country also has a rapidly growing population and urbanization, further increasing the risk and impact of disasters. Moreover, India faces several challenges in implementing disaster risk reduction measures, including limited resources, inadequate infrastructure, and gaps in coordination between different levels of government and stakeholders. There has been a great deal of scholarly investigation on the elements influencing the general public's reaction to help in catastrophe prevention and relief. The flow of information before and during disasters affects how people react, particularly in northern India; religious affiliation can influence how people react.

The underlying causes of catastrophes must also be addressed, including household adaptations and individual efforts to reduce the impact of flooding. To create a more resilient and sustainable future, communities, governments, and individuals must work together to reduce the impact of flooding. This research aimed to examine the coping mechanisms of households in the Kulgam area of Jammu and Kashmir and their knowledge of and ability to respond to flood hazards. The second part of the research examined how different indicators varied within the district and between villages based on demographic variables such as age, income, and education level.

Following an introductory portion summarizing prior knowledge in disaster management, the research moves on to a literature review, results, and discussion, and finally to a conclusion and suggestions section.

Literature Review

As disaster riposte has become more formalized, disaster planning has become increasingly significant. Every level of government administration must have a plan for dealing with emergencies and catastrophe prevention [11]. Institutional arrangements had strengths, such as sound coordination systems, but also several challenges, such as a lack of permanent and dedicated disaster management staff, limited training and awareness programs, and limited community participation in disaster management activities [12]. A disaster mitigation strategy that focuses on "waiting to get richer" would be misguided if it did not include interventions aimed at changing behavioral choices, such as the amount of disaster mitigation undertaken, location incentives, or environmental resources protection. Developing nations may need to be more aggressive in establishing policies that affect residents' behavior, possibly impacting a country's vulnerability to natural disasters as a risk [13] because a growing proportion of the world's population has chosen to make their homes in flood-prone locations, the human and economic costs of floods continue to climb [14]. One important aspect of resiliency that has received limited attention is the impact of the level and timing of outside funding on an impacted region's ability to recover [15]. Countries with a higher propensity to experience natural hazards tend to invest more in disaster prevention and mitigation measures, resulting in more minor losses in the event of a disaster [16].

On the other hand, individual-level response in disaster led to a more significant impact. Individual-level factors such as prior mental and physical disorders, lower socioeconomic status, minority group membership, low social support, presence of children in the home, and female gender can increase the likelihood of developing severe problems following a flood disaster [17].

MATERIAL AND METHODS

To conduct empirical research, a survey was administered to the people of Jammu and Kashmir to determine their level of safety and security in the face of potential floods. A multiple-bounded dichotomous choice schedule was employed for this research (MBDC). The MBDC approach is more efficient since its closed-ended questions are more accessible for responders to complete. The heads of families have been briefed on the relevance of safety measures that lower the danger of natural flood risks in their communities.

There is a wide range of flood control complexity in the Kulgam district of Jammu and Kashmir, which was the subject of this research. Most people in the Kulgam region reside near the Vishow stream of the river Jehlum. The sampling strategy was developed in response to the per capita income of the district and the record of flood disasters, both of which are positively correlated with flood management.

The District Disaster Management Authority established flood zones A, B, and C throughout the district. The level of vulnerability ranges from highest in Zone B to lowest in Zone C, whereas zone A is moderately vulnerable (DDM, 2021-22). Zone B was selected for sampling because of its high vulnerability score. There were fourteen villages in Zone B, and five of them were chosen because they were located close to the river. It was considering the total number of households in all five villages, which is 2030 [18]. The Krejcie-Morgan method yielded a sample size of 322. Thus a round figure of 350 households HH has been selected for the investigation. Seventy households were selected randomly from each of the five villages that made up the sample. According to a predetermined plan, the study interviewed the selected HH. It begins with questions on demographics and socioeconomics, including age, gender, education, and marital status.

RESULTS

Sample characteristics and descriptive statistics

Table 1 displays the sample population's probability-weighted estimates of descriptive statistics. The average respondent age was 48, and most were from four- to eight-person "nuclear" families. Female respondents comprised only 16 percent of the total sample, a substantially smaller percentage than male respondents. At the same time, 89 percent of those who participated in the survey reported being literate. While the remaining respondents are either middle- or upper-middle-class, 59 are considered below-poverty-level.

Flood Adaptation Strategy

Estimates show that compared to households in Zangalpora and Gund, to those in Arigatnoo, Ashthal, and Laiso are more likely to take measures to manage floods regularly. Several socioeconomic and Alternative shelter offers during the previous floods led to a less adaptive scenario in the village of Gund. To reduce risk exposure, residents of the town of Zungalpora relocated to safer areas. The most affected risk mitigation tools used by households in three villages were ground-level elevation (GLE) and Housing Insurance (HF). However, the least effective mitigation strategies were cleaning canals (CC) surrounding residences and sandbag deployment (DSB).

Using a Probit model, empirical estimates of the factors influencing the adoption of different flood-prevention measures at the household level are provided in Table 3. Efforts made at the level of individual households to counteract the effects of the crisis indicated **the** successful implementation of adaptive measures.

Table 1. *Sample characteristics and descriptive statistics*

Variable	N	Mean/median	S D	Min	Max
Age					
18-38	36	48	.538	18	78
39-58	246				
59-78	68				
Sex					
Male	294	.16	.367	0	1
Female	56				
Education					
No Education	38				
Jr High	50			0	4

Secondary Hr	88	2.28	1.192		
Bachelors degree	125				
Masters	49				
Fmly size					
>12(joint)	41	.55	.498	1	3
4-8(Nuclear)	194				
9-12(Joint)	115				
Annual Income					
30k-50k	59	2.79	3.00	1	4
50k-100k	37				
100k-500k	174				
500k-2000k	80				

Source: Computed

Table 2 demonstrates the estimated results on the mitigation strategy preferences of different family groups, stratified by income, education, and age.

Table 2 Factors Influenced Household's Choice over Flood Adaptation Strategy

IV	Ground-level elevation (GLE)	Housing Foundational (HF)	Insurance (I)	Cleaning canals (CC)	Deployed sandbags (DSB)
Gender	-.233 (.2325)	.423***(.2261)	.165 (.2149)	.395(.2825)	.076 (.2051)
Age	.027 (.1629)	.164 (.1522)	-.184(.1559)	.131(..1748)	.214 (.1481)
Income	1.405**(.1462)	-1.204*(.1302)	.523*(.0951)	.623*(.0965)	-.491* (.0990)
Family size	.375** (.1519)	-.663***(.1440)	-.194(.1240)	-.110(.1367)	.144(.1240)
Educational status	-.079 (.0884)	.025 (.0822)	.496*(.0803)	.400*(.0918)	-.382*(.0787)

Source: computed

***At a 10% level of significance,

*At a 1% significance level,

**At a 5% significance level,

Values in parenthesis are standard error

Estimates show that residents of all selected villages prioritized risk management strategies, focusing on insurance. A lack of resources and an unstable political climate hampered households' limited adoption of sophisticated mitigating measures. In all five of these study villages, it was assessed that there was a different level of inadequacy for adaptive strategies. The data has been analyzed at different significance levels. There is no fixed status for the flooded households; the extent to which a family is affected depends on the household's individual vulnerability and capability to absorb shocks. The data has been evaluated at various levels of significance. The findings regarding gender status are reinforced by local tradition and customs in the study areas, strengthening the idea that gender disparity plays a role in implementing decisions. The critical flood risk reduction strategies positively correlate with household income, with higher-income families adapting to flood risk in more significant numbers. There is a negative correlation between household size and the adaption of flood risk mitigating strategies. Due to a higher dependency ratio and fewer potential income earners, larger families have a negative coefficient, indicating they are less likely to save for emergencies. Education and income play a crucial role as they try to adapt preventative measures in response to potential threats posed by flooding. According to the adaptation of flood coping methods, education suggested mixed findings.

DISCUSSION

Sample characteristics and descriptive statistics

Most Kashmiri culture is patrilineal and virilocal, which means that after marriage, women relocate to the area of their husband's patrilineage; this is the main reason why there are so few female heads of households [19]. Most of the respondents are in their middle years, and individuals of this age group often point to positive aspects of their surroundings, such as beautiful scenery, a sense of security, and a sense of community, as reasons for their quality of life [20]. While 89 percent of respondents were literate, the 2011 census report indicated that just 69 percent of the population in the Kulgam region was literate [21]. Education is crucial to decrease catastrophe risk at the state or individual levels. "Disaster Reduction, Education, and Youth" was initially discussed at the UN Global Disaster Reduction Campaign in 2000 [21]

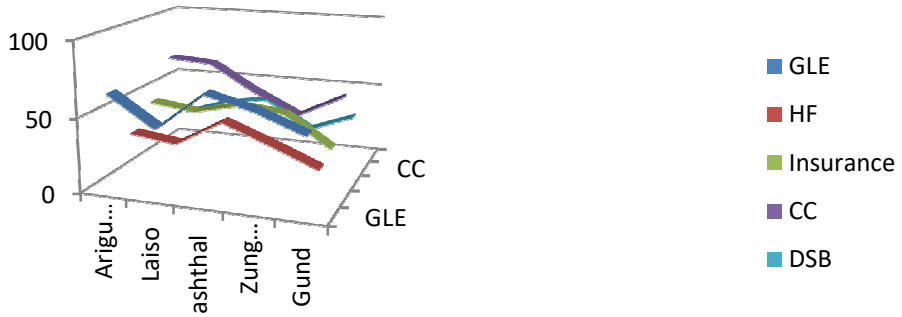
According to the Union Cabinet-approved methodology, a household's yearly income must be at or below $27,000 to be included on the BPL (Below Poverty Line) list. Based on such assumptions, the lowest income bracket was pegged at around 30,000 annually. Data from the higher-income category has been excluded since no group members participated in the research. In India, middle-class families spend most of their income on rent and other living expenses. Families in the middle class may get by on an income of between $15,000 and $35,000 per month. The study assumed that the average household spends $25,000 each month. An income range of 2000 to 5000 has been developed for responders in the lowest income category.

Flood Adaptation Strategy

Factors such as gender, age, income, family size, and level of education have been accounted for independently. Dependent adaptive measures for the Probit model include the ground level elevation (GLE), the foundation (F), the insurance (I), the cleaning canals (CC), and the deployed sandbags. In most cases, the locals only considered implementing old-fashioned, chronologically-based mitigation measures and prevention tactics while ignoring the need to modify all mitigation strategies [22].

There is no disagreement between males and females about the effect of ground-level elevation as a flood adaptation measure. While statistically insignificant, there is a good gender association with insurance (I), housing foundation (HF), canal cleaning (CC), and sandbag deployment (DSB). Ultimately, gender has little impact on the considerations with which a family makes decisions on flood adaptation techniques. The gender status findings are backed by local customs and traditions, emphasizing men's greater participation in decision-making than women. Males were considered superior to females regarding physical strength, construction expertise, and the ability to take preventative precautions against property loss in a natural disaster [23].

Figure 1: Adaptation strategies on the village level.



Regarding social indicators, age is significant when considering people's potential and capacities in the face of natural catastrophes like floods, which calls for development in rural areas [24]. All dependent variables except insurance have positive coefficients when age is included. Regarding age, there is no link between any of the dependent variables. A drop in house insurance purchases was associated with older age (negative coefficient of age with insurance (I). Those between the ages of 18-29 and those between the ages of 30-58 favored insurance policies over those between the ages of 59-75.

A household's economic position (income) plays a crucial role in determining its sensitivity to flooding hazards and developing strategies for dealing with that risk individually [25]. Household income was a critical factor in making disaster-resistant houses in this study. As a result, people's outlook on flood adaptation measures improves in parallel with increased household income. When income rises by one lakh INR, insurance purchases climb by 52%, and individuals also raise the ground level of their homes.

In addition, individuals have taken to cleaning canals as a method of flood control. So, people's efforts to clean the channels of their communities grow in proportion to their rising standard of living. Yet the analysis confirms what people see: those individuals neglect the strengthening foundation level of their new homes. Every one of these tallied estimates is statistically significant.

A person's flood adaptation plan should consider the number of members in their household. An increase in family size directly impacts a household's consumption and expenditures, leading to less funding available for secondary measures like flood adaption strategies. The study confirms a previous finding that as the proportion of non-nuclear families grows, people tend to choose fewer forms of adaptation.

The choice of housing with flood-adaptive measures was similarly affected by the level of education and household income. Higher levels of education have resulted in a more significant number of people using preventative flood measures. The findings show that as people's education levels rise, they are more

likely to opt for a comprehensive insurance package (I) and a customized housing foundation (HF). Information about potential disasters is disseminated through education, influencing people's mindset toward appropriate strategies. The findings highlight the importance of education in terms of insurance (I) and cleaning canals (CC) but not concerning housing foundations (HF).

As for the age influence on adaption mitigation strategies, a positive and substantial correlation was observed between age and ground-level elevation (GLE) and insurance (I) coverage, although there is a negative and insignificant correlation between age and Housing Foundational (HF), positive age coefficients for ground-level elevation (GLE) and (I) suggest that older households value these features more than younger ones do.

The size of a household has a significant bearing on the likelihood of using flood-prevention measures. Due to a higher dependency ratio and fewer potential income earners, a larger family size is associated with a decrease in precautionary saving, as indicated by the negative coefficient of family size. Because of low income and limited means, families are more likely to suffer the effects of natural disasters like floods.

CONCLUSION

The research aimed to examine the coping mechanisms of households in the Kulgam area of Jammu and Kashmir and their knowledge of and ability to respond to flood hazards. The research also examined how different indicators varied within the district and between villages based on demographic variables such as age, income, and education level. A survey was administered to the people of Jammu and Kashmir using a multiple-bounded dichotomous choice questionnaire. The heads of families were briefed on the relevance of safety measures that lower the danger of natural flood risks in their communities. The study selected Zone B for sampling, a high vulnerability area, and five villages were chosen from the zone. Three hundred fifty households were selected for investigation using the Kjecie-Morgan method, and 70 homes were selected randomly from each of the five villages that made up the sample. The research findings indicate that education is crucial in decreasing catastrophe risk. The research also found that in most cases, locals-only considered implementing old-fashioned, chronologically-based mitigation measures and prevention tactics while completely ignoring the need to modify all mitigation strategies. The study found no link between age and dependent variables except for insurance. Lastly, the study found that gender has little impact on the considerations with which a family makes decisions on flood adaptation techniques, backed by local custom and tradition emphasizing men's greater participation in decision-making than women.

Overall, implementing comprehensive disaster policies and advanced adaptation measures is crucial to reduce the impact of disasters on local communities. Development requires the implementation of comprehensive disaster policies that take into account local conditions and potential hazards. This can include measures such as spatial planning to ensure that buildings and infrastructure are located in safe areas, house building codes to ensure that buildings are constructed to withstand potential hazards, and the development of resilient infrastructure to potential disasters.

In addition, the propagation and forecasting of updated flood information are essential to inform local communities about potential hazards and provide early warning of impending disasters. This can help to reduce the impact of disasters by allowing individuals and communities to take advanced adaptation measures, such as moving to safer areas or reinforcing their homes and buildings.

Advanced and updated early warning systems are also crucial for providing timely information to those at risk and allowing evacuation and emergency response efforts to be mobilized quickly and effectively. This requires the development of advanced technology and infrastructure and the training of local emergency responders and community members to ensure that they are prepared to respond to disasters when they occur.

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