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## **Assessing Local Community Response and Vulnerabilities to Flood Risks: A Case Study of Agra Union Council, District Charsadda, Pakistan**

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### **ABSTRACT**

Floods are also one of the most devastating natural calamities to hit Pakistan, especially the District Charsadda in the province of Khyber Pakhtunkhwa which has experienced one of the worst floods given that the area lies at the meetup of Kabul and Swat rivers. This paper will inquire about assessing local community reaction to the vulnerabilities of floods within the flood-prone Agra Union Council at the level of economy, physical, psychological, and social aspects of vulnerability. Employing the instrument of quantitative cross-sectional survey carried out among 150 male respondents aged 18 to 65, the project collected the data through structured questionnaire administration and analyzed it considering the descriptive statistics and Chi-square tests, which allowed investigating the connection between the vulnerability factors and the community reactions.

The findings show that poverty plays a massive role in making the situation of flood vulnerability stronger since the poor income households tend to settle in the floodable areas and stay in the humble constructed mud houses which lack professional advice and are not raised. Preparedness and resilience is determined by economic status, whereby, individuals with low economic status/means have more crop losses and more damage of housing. Mental effects such as anxiety, depression, and fear due to flooding were widespread and disadvantaged the coping abilities. Social vulnerabilities are reflected not only in poor governmental and NGO responses but also in the existence of some of the flood warning systems and collaboration within communities.

Major bivariate relationships point to the inseparability of the relationships amid the economic, physical, psychological, and social vulnerabilities in defining community response patterns. Even though with the direct experience of the flood, residents are prepared to a certain degree; there are still some gaps on the structural, informational, and institutional levels.

The proposed policy offered in the study would incorporate comprehensive flood risk



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reduction-focused policies on economic uplifts, improved infrastructures (sidewalls, drainage), professionally informed housing construction, mental health care, increased early warning systems, and government, and non-governmental action. Such attempts are essential in developing resilience and adaptive capacity of flood-affected populations in Charsadda and other similar areas.

**Key words:** Psychological vulnerability, Social vulnerability, Flood preparedness, Disaster risk reduction, Flood-prone communities Charsadda, Pakistan Flood resilience, Community coping strategies

### Introduction

Flooding is one of the most frequent and catastrophic natural phenomena on Earth, whose frequency and severity are thoroughly associated with such global trends as climate change and environmental degradation (Hirabayashi et al., 2013; Winsemius et al., 2016). The province of Khyber Pakhtunkhwa and the whole of Pakistan is under a significant risk of flooding because of geographical conditions and the evolving climate (Awan et al., 2020). The district of Charsadda, which is located at the point of meeting the Kabul and Swat rivers, is prone to periodic riverine and flash floods that are compounded by either extreme monsoon rainfall, or lack of trees due to deforestation and proper flood mitigation systems (Khan et al., 2022).

The people that reside in Agra Union Council in Charsadda are usually in low lying places that frequently experience floods and their homes are constructed out of weak materials such as mud and weakly reinforced buildings (Ahmad, 2020). Economic factors compel mainly low-income families to reside in areas with high risks of flooding that predispose them to flood losses (Fatemi & Sharifi, 2019). Remarkably, the lack of sufficient flood defenses like sidewalls and drainage adds to the community vulnerability in addition to few early warning or disaster preparation (WMO, 2021).

However, even though floods are a regular occurrence in Charsadda, it remains an inadequate grasp of how regional socio-economic, physical, psychological, and social weaknesses lead to local flood response and resilience (Naseer et al., 2021). Insufficient community participation, institutional coordination, and evidence-based localized interventions have been known to negatively affect current disaster management activities (Zare et al., 2022). The effects of the psychological impacts, like the anxiety and depression prompted by frequent flooding, also decrease community coping abilities (Patel et al., 2021). Since floods are a threat to livelihoods and development, it is imperative to examine the subtle nature of the vulnerabilities and community engagements with the view to enhance resilience-building approaches.

This research effort will address the research gap because it will entail a detailed evaluation of multidimensional vulnerabilities and the coping behaviors adopted by the flood-prone Agra Union Council residents. The research results will guide policymakers, disaster management officials, and the non-governmental sector to develop specific interventions to serve the need of flood risk reduction based on physical and psychosocial support of the infrastructural development efforts (Sharma et al., 2023). The improved knowledge of the community-based flood dynamics is essential to the Sustainable Development Goal 13 on climate action and disaster resilience (UNDRR, 2022).



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### Research Objectives

To identify socio-economic, physical, psychological, and social vulnerabilities to flooding in Agra Union Council, Charsadda

To evaluate local community responses, preparedness, and coping strategies related to flood events.

To analyze associations between different vulnerability dimensions and community resilience outcomes

### Materials and Methods

#### Study Area

Agra Union Council (UC) was the location of the study in the District Charsadda in Khyber Pakhtunkhwa, Pakistan. The Charsadda District is situated in the confluence of Swat and Kabul rivers and is therefore highly prone to riverine and flash flooding particularly when it experiences the monsoon season. Agra UC is the most prone area that is affected by floods in the Charsadda area with a large percentage of the population lying in the low-lying flood-prone regions with poor infrastructure housing system.

#### Study Design

The study used the quantitative and cross-sectional survey research design to evaluate systematic response of the local community towards the flood vulnerabilities. The cross-sectional design enabled the gathering of the data that depicted the actual condition of the socio-economic, physical, psychological, and social aspects of vulnerability conditions with respect to the exposure to flood at a given period of time.

#### Population and Sample Size

The targeted group was the male residents of households affected by floods aged 18-65 years in Agra UC. The sample size was calculated according to the Cochran formula the large population and reinforced by means of the sampling table by Cochran (or a similar table labeled as Sakaran listed in the thesis). The sample was composed of 150 male respondents which represented a section of people who were prone to floods in the region.

#### Sampling Procedure

Simple random sampling method was used to draw participants in the flood affected households in Agra UC. The selection of male respondents in this socio-cultural setting was homogenous in that there would be reliability in the self-reported information on the flood vulnerabilities and the community actions.

#### Data Collection Instrument

The information was retrieved using a structured questionnaire that was specifically prepared in the survey. The questionnaire was composed of a series of sections that included:

Socio-demographic background (age, education, occupation, family type, monthly income)

Dependent variable responses by the local communities to flood vulnerabilities

Economic weaknesses (independent variables)

Independent variables such as physical vulnerabilities

Physical vulnerabilities (independent variables)

Psychological/Attitudinal vulnerabilities (independent variables)



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Social vulnerabilities (independent variables)

The tool also contained close questions with Liker-reactions (Agree, Disagree, and Neutral) to capture the perceptions and experiences associated with the nature of flood impact and coping mechanisms.

### Data Collection Procedure

The face-to-face structured interviews with the respondents at their homes were administered using the trained field enumerators. The predominantly literate and the illiterate populace were interviewed to make it very inclusive. Local languages were used in the conduct of the sessions in order to ensure better comprehension and accuracy amongst the respondents. The principal investigator monitored the collection of information to ensure quality and uniformity.

### Data Analysis

The data that was gathered were coded and imported into SPSS (Statistical Package for social sciences) version 22 in order to analyze it. Such statistical analyses were conducted:

Univariate Analysis: Frequencies, percentages and measures of central tendency characterized the demographics of the target population and their answers to the specific questions in the questionnaire.

Bivariate Analysis: Chi-square tests were applied to investigate relationships between independent variables (economic, physical, psychological, and social vulnerabilities) and the dependent variable (local community response towards to flood vulnerabilities). A  $< 0.05$  p-value was regarded to be statistically significant.

### Ethical Considerations

Before interviews, the respondents were made aware of the purpose of the study as they gave verbal consent. The necessity to provide confidentiality and anonymity was guaranteed through avoiding any personal identifiers in the dataset. It was voluntary, and the respondents were allowed to leave anytime

### Results

#### Socio-demographic Characteristics of Respondents

It included 150 male participants of the age group ranging from 18 and 65 years residing in Agra Union Council, District Charsadda. Those below the age of 30 years constituted 37.3% while those above 50 years constituted 26.7% of the sample size (see Table 4.1). The majority (56.7%) were unable to read and write and 74.7% were wives. The largest percentage of families in joint families was 51.3% and farmers 44.3% in terms of occupation. More than half of the respondents had a monthly income of less than PKR 30,000, showing that also majority of respondents belong to lower income group and most vulnerable to floods.

**Table 4.1: Socio-demographic Characteristics of Respondents (N=150)**

Variable	Category	Frequency	Percentage
Age	Below 30 years	61	37.3
	31–40 years	30	20.0
	41–50 years	19	16.0
	Above 50 years	40	26.7



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Education	Illiterate	85	56.7
	Literate	65	43.3
Marital Status	Married	112	74.7
	Unmarried	38	25.3
Family Type	Joint Family	82	51.3
	Nuclear Family	49	32.7
	Extended Family	16	16.0
Occupation	Farmer	68	44.3
	Labor/Other	62	42.3
	Govt Servant	10	6.7
	Shopkeeper	10	6.7
Monthly Income	Below PKR 30,000	76	50.7
	PKR 30,000–50,000	44	29.3
	PKR 50,000–70,000	20	13.5
	Above PKR 70,000	10	6.5

Table 4.2: Local Community Response Indicators

Statement	Agree (%)	Disagree (%)	Neutral (%)
Firsthand flood experience	72.7	24.0	3.3
Local authorities facilitate vulnerable areas	52.7	42.7	4.6
Drainage channels crucial for water flow	86.0	10.0	4.0
Local community responds to floods effectively	36.7	58.0	5.3
Presence of sidewalls	45.0	25.3	25.3
Flood communication system exists	4.0	78.7	17.3
PDMA provides flood awareness	26.0	66.0	8.0

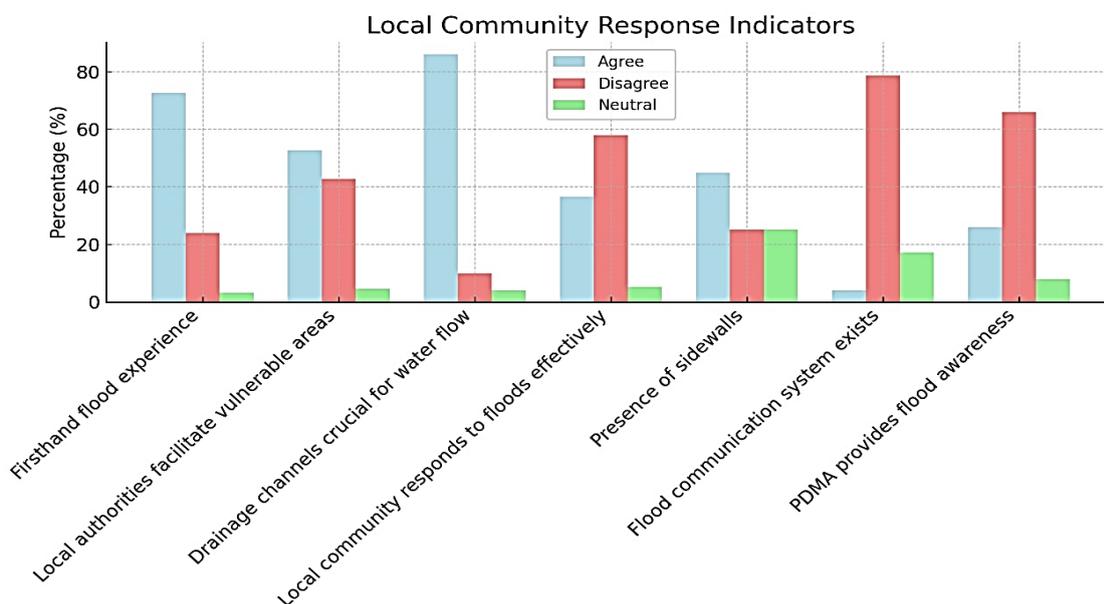


Figure 1: Local Community Response Indicators



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**Local Community Response towards Flood Vulnerabilities**

Confirmation of firsthand flood experience was present in most of the respondents (72.7%), which shows that the community was directly and extensively exposed to flood (Table 4.2). More than half (52.7%) had the feeling that the local organs make efforts around the vulnerable regions. The need of drainage systems was fully accepted (86%), however, it was only found that 36.7% of people thought that the local community was adequately active in responding to flood vulnerability. Forty five percent reported presence of flood defense structures such as sidewalls. Only a small percentage (4%) admitted to having an effective flood communication structure and the majority (66%) believed that the Provincial Disaster Management Authority (PDMA) failed in giving sufficient flood awareness.

**Table 4.3: Economic Vulnerability Factors**

Parameter	Agree (%)	Disagree (%)	Neutral (%)	$\chi^2$ Value	P-Value
Poor families more vulnerable to flooding	52.7	37.3	10.0	35.167	0.027
Economic status reduces vulnerability	61.3	28.7	20.0	24.692	0.020
Poor people buy cheap flood-prone land	50.0	22.7	27.3	19.043	0.011
Crops are vulnerable	68.0	12.7	19.3	26.664	0.005
Sidewalls reduce vulnerability	64.7	24.0	11.3	25.504	0.030

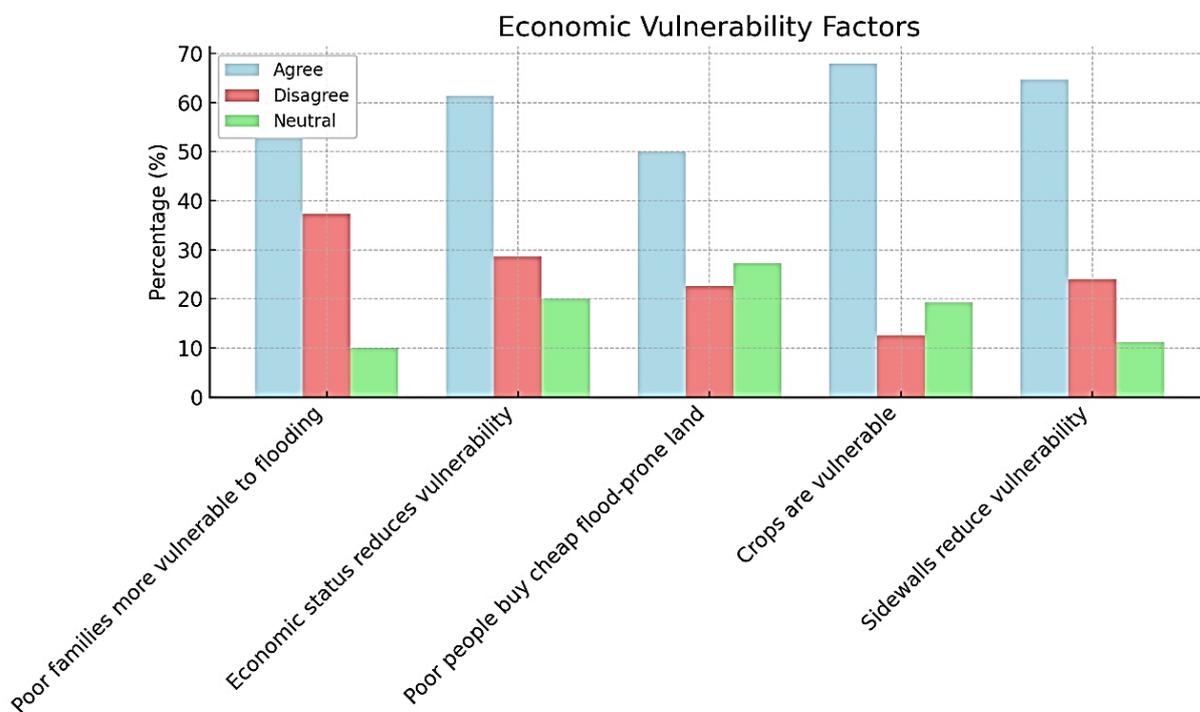


Figure 2: Economic Vulnerability Factors

**Economic Vulnerability and Its Association with Community Response**

Economic exposure was very high whereby 52.7 stated that poor households are the targeted group of floods. Most of them (61.3 percent) acknowledged that economic status



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determines avoidance of floods. A half of the respondents stated that lower income households tend to buy flood-prone land which is cheaper. Sixty eight percent recognized risks to crops and 64.7 confirmed that sidewalls lower flood risk (Table 4.3). The results of bivariate Chi-square supported statistically significant correlation ( $p < 0.05$ ) amid the elements of economic vulnerability and local community flood response, which justified the significant role of economic conditions as the flood risk exposure and coping capacity factor.

Table 4.4: Physical Vulnerability Factors

Parameter	Agree (%)	Disagree (%)	Neutral (%)	$\chi^2$ Value	P-Value
Low-cost house materials increase vulnerability	47.3	42.0	10.7	9.146	0.038
Houses made of bricks	54.0	26.0	20.0	45.042	0.019
Structural integrity crucial	66.0	16.7	17.3	41.722	0.031
House equipped to prevent wastewater flood	16.7	77.3	6.0	4.247	0.371
Consulted skilled experts before building	13.3	72.7	14.0	2.041	0.728
House elevated above flood level	31.3	52.7	16.0	22.308	0.391

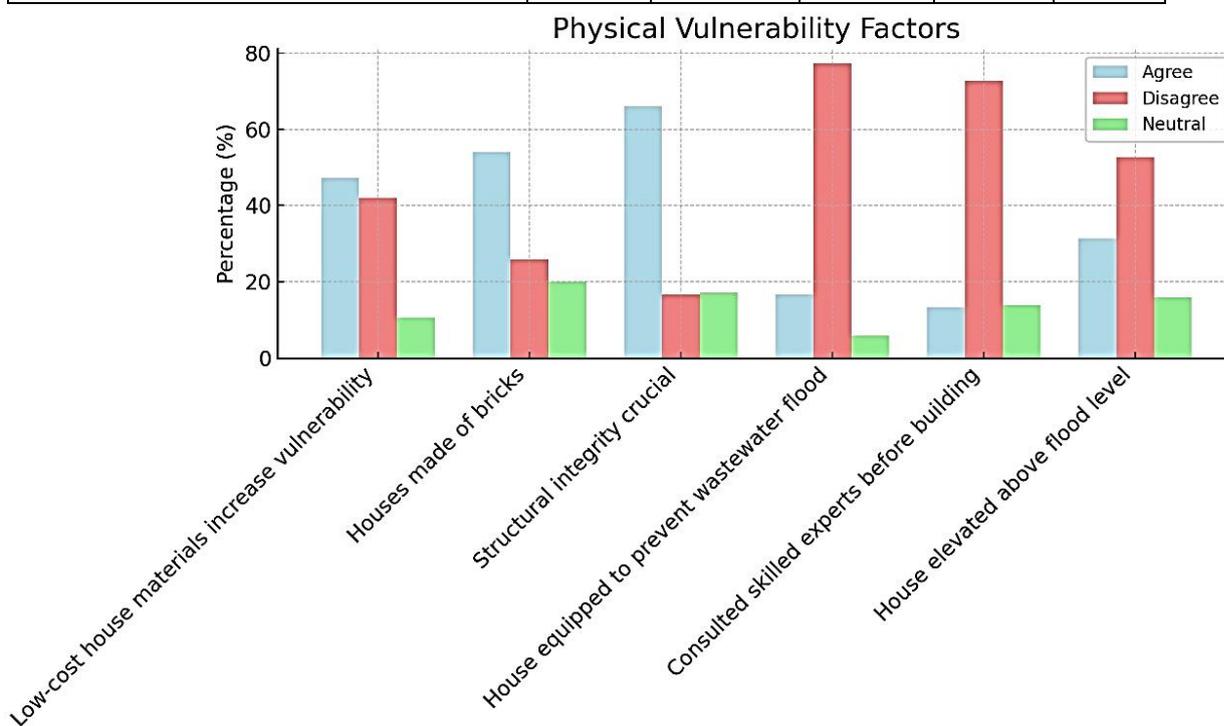


Figure 3: Physical Vulnerability Factors

Physical Vulnerabilities and Community Response

Approximately 47.3 percent of people recognized that the residence made of cheap materials is particularly susceptible and 66 percent mentioned that the structure of the house composition plays an extremely important part in the resistance to floods. More than half (54 percent) lived in brick houses. Gutter or waste water flood prevention was not prepared in majority of the houses (77.3%) and majority of the houses (72.7%) had



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not consulted professional minds before construction. A mere 31.3 percent resided in a house that was built on high grounds and it was superior to the expected level of flooding (Table 4.4). According to chi-square analyses (Table 4.8), there were substantial associations between various physical variables (building materials, structural integrity, perceived vulnerability) and community flood response (  $p < 0.05$ ), but not other variables, such as wastewater prevention systems, expert consultation.

**Table 4.5: Psychological Vulnerability Factors**

Psychological Factor	Agree (%)	Disagree (%)	Neutral (%)	$\chi^2$ Value	P-Value
Mentally prepared for upcoming flood	38.0	42.7	19.3	27.019	0.013
Flood harms human health	87.3	12.7	0.0	21.910	0.000
Fear when living near river banks	82.7	11.3	6.0	31.500	0.047
Depression related to floods	67.3	22.0	10.7	34.350	0.025
Left home during monsoon rainfall	43.7	52.0	3.3	41.117	0.005

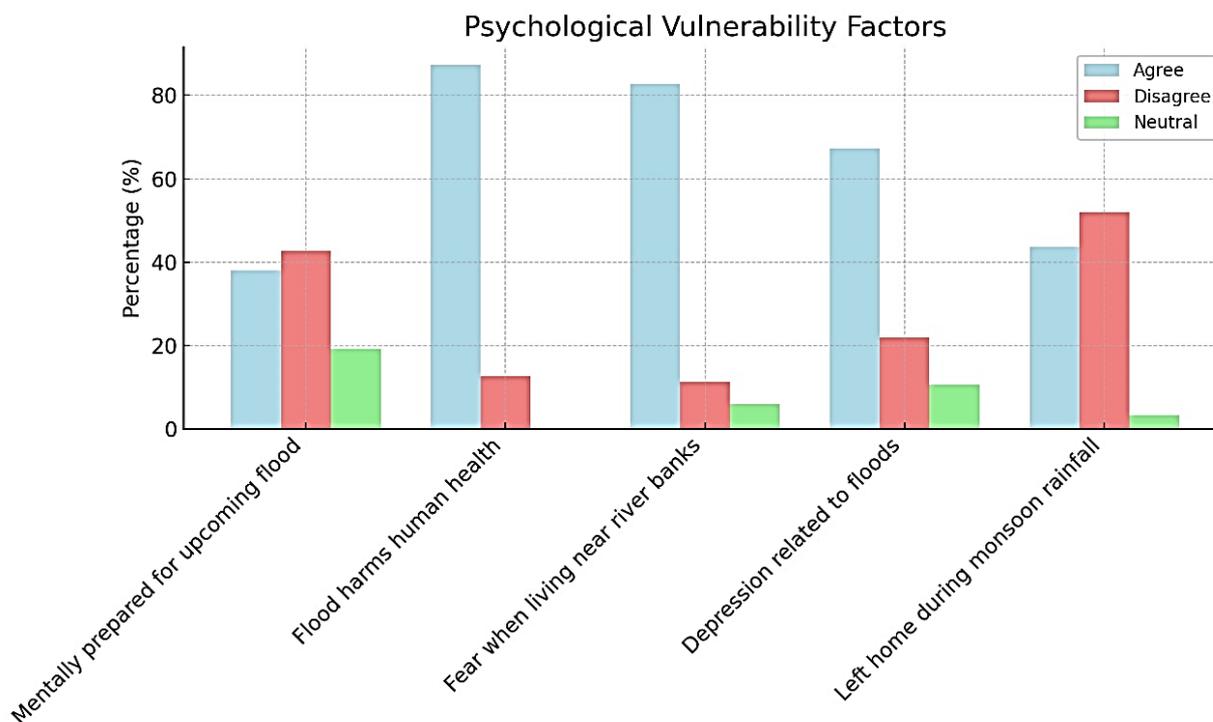


Figure 4: Psychological Vulnerability Factors

**Psychological / Attitudinal Vulnerabilities and Community Response**

There were considerable psychological effects of flooding: only 38% were mentally ready to face any flood in future; 87.3 percent of the population admitted that floods are deleterious in human health; 82.7 percent of the people were afraid of the river-side living; and 67.3 percent of the population was depressed due to floods. Moreover, 43.7 percent had gone out of homes in the presence of monsoon rains (Table 4.5). The statistical associations of community flood response with psychological factors revealed



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statistically significant results ( $p < 0.05$ ) based on the chi-square findings (Table 4.9) which indicated the usefulness of the psychological preparedness on the effective coping with the floods.

**Table 4.6: Social Vulnerability and Institutional Support**

Parameter	Agree (%)	Disagree (%)	Neutral (%)	$\chi^2$ Value	P-Value
Flood warning system available	74.7	22.7	2.7	32.50	0.039
Adoption of new approaches	46.7	32.7	20.7	34.41	0.025
Government activities before floods	8.7	58.0	33.3	3.641	0.457
NGOs provide awareness workshops	12.7	60.7	26.7	37.722	0.001
Community helps during floods	52.0	38.0	10.0	32.965	0.004
Government needs more flood focus	79.3	18.7	2.0	37.602	0.007

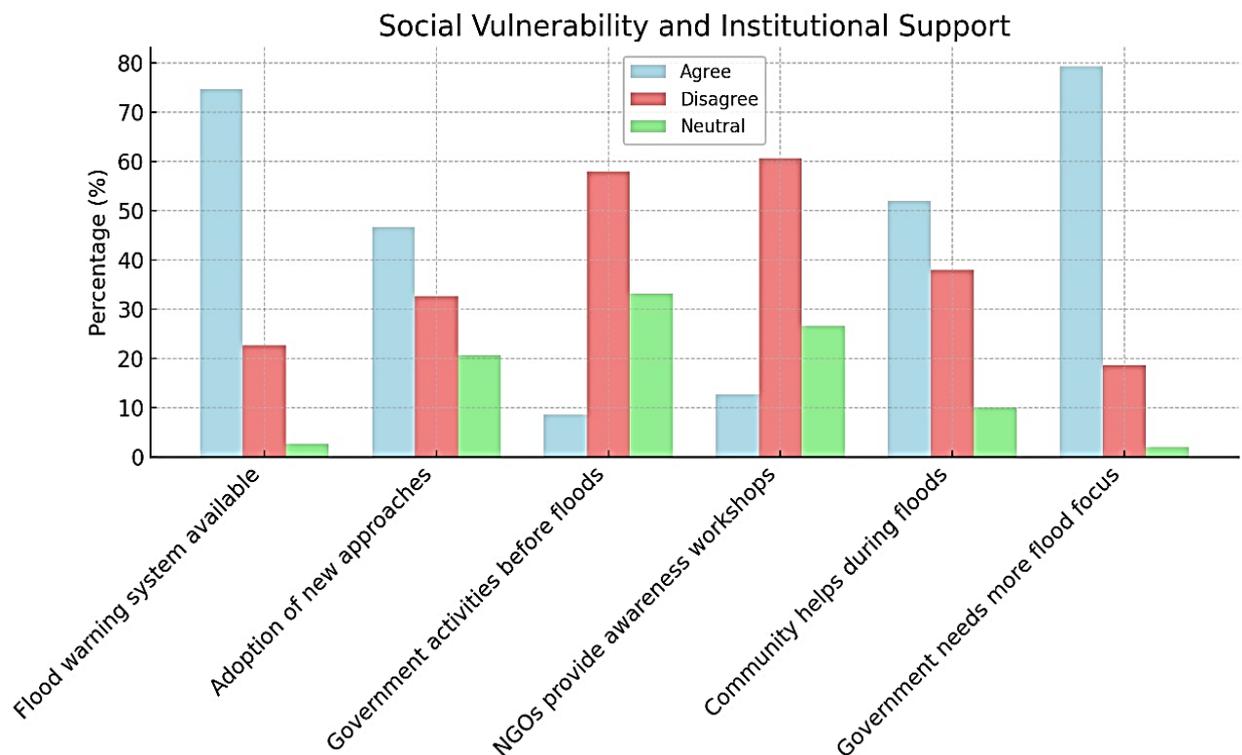


Figure 5: Social Vulnerability and Institutional Support

### Social Vulnerability and Institutional Support

The majority of those responding (74.7) said that there was flood warning system where they lived (Table 4.6). A minority (46.7%) also felt that vulnerability can be decreased by adopting new techniques. Only 8.7 percent recognized the government functions prior to floods and 12.7 percent responded that the NGOs hold awareness workshops. Nonetheless, 52 percent affirmed the level of cooperation among the community when floods strike, and 79.3 percent emphasized that the government needed to pay more attention to the regions that are prone to flood. The chi-square test (Table 4.10) indicated



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that social environmental factors, which included flood warnings, new strategies, awareness with regard to the presence of non-governmental organizations, cooperation in the community, policies as well as government focus had significant associations with the community flood response ( $p < 0.05$ ). Pre-flood government activities and community coping alone were not major.

### **Discussion**

This paper has discussed the local community attitude to flood vulnerabilities of Agra Union Council, District Charsadda, Economic, Physical, Psychological/Attitudinal and Social aspects of vulnerability have been reviewed. The review showed that multidimensional vulnerabilities were playing a great role when it comes to the ability of residents to respond and deal with floods. The analysis provided below combines both observations of the empirical findings and literature that is related to the problem and the implication of policy and practice.

### **Social-demographic Context and Vulnerability**

The socio-demographic characteristic of respondents is low-income farming community which is largely illiterate and living in joint families. This demographic setting increases the vulnerability to floods because poor education would limit knowledge and information on floods, and poverty would limit resistant housing or tolerance to move to an area that is considered safe. This is in line with Nakagawa (2004) and Khan et al. (2017), who explain that, low socio-economic status makes a significant determinant of vulnerability that increases flood risks among communities.

### **Economic Vulnerabilities and Their Impact on Flood Response**

Economic vulnerability turned out to be a dominant agent of local community response to flood risks. More than half the respondents admitted that there is a disproportionate targeting of poor families by floods since they buy cheap land that are located in areas prone to floods. Such observation supports the claims of IFRC (2010) and Balica and Wright (2010) who report that poverty leads to settling in risk prone areas and construction of substandard houses using cheap materials.

The important correlations between the economic status and community responses give emphases to the fact that monetary capacity dictates the vulnerable and ready. It is important to note that the respondents agreed that economic status may be used to overcome flood vulnerability by improving the housing types and features protective measures like sidewalls. This shows that economic empowerment programs and infrastructural investments are very crucial aspects of flood risk mitigation strategies.

### **Physical Vulnerabilities - Quality of Housing and Structural Conditions**

The factors of physical vulnerability associated with the types of materials in housing and the quality of constructions played a big role in the effects of floods and community responses. The first result was the fact that almost 50 percent of respondents considered mud and low-cost materials weak, whereas the quality of buildings was identified as the key resilience factor. Most of the houses did not have wastewater protection systems in place and had not received expert assistance in the construction showing lapses in terms of providing technical assistance and regulatory monitoring.

These results support earlier research (Tran & Blaha, 2009; Thouret et al., 2014) on the need to construct standards and above-anticipated level of flood. Lack of elevated and flood-resistant housing severely restricts the safety and the ability to recover and,



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therefore, there is a dire need in technical training, building code enforcement, and policies that will encourage the use of resiliency construction.

### **Psychological and Attitudinal Vulnerabilities**

The research indicated significant psychological vulnerability relating to floods experiences. Most of the respondents explained that they did not have a mental preparedness towards floods, that they were always in a state of fear along the banks of rivers and depressed due to floods. The concern over rains during the monsoon season and a tendency of certain locals to abandon houses when the precipitation is intense also demonstrates that the situation is chronically stressful.

These results find a parallel to the Patel et al. (2021) and Lee et al. (2021) studies that outline the long-term psychological impacts of floods, such as anxiety, depression, and Post-Traumatic Stress Disorder associated with floods, in particular, low-income countries. Psycho social support and awareness campaigns should be a part of disaster preparedness that should go hand in hand with the physical and economic intervention in terms of building a holistic resilience.

### **Institutional support and Social Vulnerabilities**

The social predisposition was marked by poor levels of government operation, inadequate NGOs awareness campaigns, but the community had decent levels of coordination in times of floods. Availability of flood warning systems in close to three-quarters of the areas covered by respondents can be considered as an initial institutional attempt, but the dearth of perceived pre-flood governmental response and the lack of awareness on the part of PDMA/NGOs suggests systemic failures.

This is also supported by the high rate of agreement that the flood vulnerability that the government focuses on should be improved by the results of a study by Zare et al. (2022) regarding weak institutional arrangements in Pakistan in the context of floods risk management. Heavy correlation of social support factors with the community response implies that building on local governance, expanding flood communications network, and engaging in multi-stakeholder collaboration with coordinated efforts are the essential areas to enhance coping capacities as well.

### **Integration of Vulnerabilities and Implications for Community Resilience**

In bivariate analysis, the multi-dimensionality of flood vulnerability was accentuated with the economic, physical, psychical, and social dimensions being interwoven and acting together in shaping the response of communities. This is emphasized by the strong correlations in almost all dimensions and proves that flood resilience has to be treated in an integrated manner with such elements as poverty alleviation, good housing, mental health support, and institutional empowerment involved.

The poor preparedness and the low capacity to work with response following the intense experience in floods indicate the insufficiencies on addressing knowledge and the early warnings to practical action, one that is highlighted by Mechler & Bouwer (2014) as well. Strong governmental investments in water and infrastructure, technical recommendations, and decentralized policy frameworks that can serve to empower local communities need to supplement community-based strategies of disaster management.

### **Conclusions**

The paper has been critical in the analysis of the local community reactions to flood susceptibilities within the Agra Union Council of Charsadda district in Pakistan. The



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results indicate that flood vulnerability is a multidimensional, multifaceted process that is determined by economic, physical, psychological/attitudinal and social dimensions, which have a combined impact on the ability of the communities to meet the challenges of the flood disasters (preparation, response, and recovery).

Poor and low-income families are overrepresented among the victims facing such extreme vulnerabilities in the economic sense in the sense that they have to live in flood-prone areas and build their houses in poor building materials due to the high costs involved. Poverty is a major factor in the increased exposure to the flood while its weight on flood resilience is also a significant problem due to economic limitations that households have to invest in safe housing or any other protective infrastructure.

The physical vulnerabilities were a major determining factor to flood impact and these included poor housing structures, poor building materials, the building height inadequate elevation above the rising waters and poor technical consultation. Most of the households did not have waste water protection and resilient structures, hence, the importance of better standards in buildings and professional advice.

On the psychological aspect, floods have caused increased fear, anxiety, depression, and mental distress among the members of the communities, especially individuals residing along the riverbanks. These mental factors negatively affect preparedness and coping strategies in that psychosocial support should be incorporated in the management of flood disasters.

It can be said that social vulnerability was shown through poor institutional input, low involvement of the government in the pre-flood activities, and poor awareness programs facilitated by NGOs. Although there is a community cooperation, it is weak when on its own and government need to provide more participation, early warning action and concerted actions.

The determinations of the statistical associations proved that the vulnerabilities are not autonomous but connected to each other influencing local community responses as a whole. Despite the substantial experience of the community with flooding, the level of preparedness and one that actively copes is rather low. The results show that integrated and multidisciplinary practices are critical in establishing flood resilience in Charsadda.

Overall, the paper has found that the vulnerability in this area needs to be decreased through dealing with underlying socio-economic disparities, enhance physical infrastructure, mental health promotion, and institutional capacity building and communication through communication channels to raise awareness and enhance community engagement and early warning.

### **Recommendations**

Based on the study's conclusions, the following targeted recommendations are proposed to enhance flood resilience and improve local community response in flood-prone areas of District Charsadda:

Government should need to make special policies and planning for flood vulnerable areas.

Government need to made sidewall on river bank which minimize the flood effects.

Government should need to establish flood information centers in vulnerable areas which will help people to know about flood vulnerabilities.

NGOs must visit flood vulnerable areas and do workshops on flood preparedness.

It is essential to advance a typical cooperation between the networks of different institutions like media, schools or religious and to support powerful flood reductions plans in communities.

If each individual in the community is familiar with methods of adapting and coping steps, then, the interruption of flood vulnerability can be easily decreased.

If a person is anxious about flood, then he would be convinced to migrate from that place.



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Houses should be built high from water level.

People should ask from experts for making shelter in vulnerable area.

For buying land, people should know about flood vulnerable areas.

Several administration ministries and mechanical institutions have such variety of scientific capabilities to give awareness to local communities.

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