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Determining factors affecting flood risk perception among local communities in Iran

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Although climatic and environmental factors primarily determine the intensity of flood events, their impacts on residents are significantly influenced by human-related elements. Since the most floods are highly variable and unpredictable, it is crucial to enhance the capacity and resilience of residents to withstand and coexist with these disasters. To increase the resilience and adaptability of rural households in the face of floods, it is essential to first address individuals' risk perception as a critical issue. This study was conducted with two primary. Objectives (1) to assess the current status of risk perception and (2) to identify the factors influencing flood risk perception (FRP) among local communities. The research population comprised all rural households in the Shushtar County (Southwest Iran) who had experienced at least one flood event. The primary research tool was a questionnaire, and data analysis was performed using SPSS software. Correlation coefficient results indicated significant relationships between age, frequency of flood occurrence, education, distance of water channels and rivers from properties, flood exposure, housing quality, risk information, flood coping information, and financial incentives for recovery with dimensions of risk perception, namely preparedness, worry, awareness, and experience. Additionally, hierarchical regression results demonstrated that these variables could explain 55.4% of the variance in FRP. Overall, the findings of this study can significantly assist policymakers in designing flood risk reduction programs and facilitating safer living conditions in flood-prone areas.

Keywords Risk perception, Flood risk, Flood risk reduction, Climate risks, Iran

Globally, the occurrence of natural hazard and their impacts, including fatalities, casualties, and overall estimated economic costs, are on the rise[1,2]. Water-related disasters are one of the most undesirable and increasing global challenges, posing severe economic and social threats to low-income human communities[3,4]. In the 20 years leading up to 2015, floods and other water-related events constituted nearly 90% of all natural hazard, affecting approximately 2.3 billion people and causing around $300 billion in economic damages[5]. The frequency and severity of flood hazards continue to escalate worldwide, making these events increasingly unpredictable and destructive[4]. Studies suggest that the impact of floods will intensify in the coming years, potentially affecting about 40% of the global population by 2050[6].

Developing countries are most affected by natural hazard, with floods posing a particularly significant threat. These effects can be mainly attributed to poor housing conditions, poverty, low adaptability, and weak or inadequate infrastructure[6]. The inability to develop effective flood risk reduction strategies presents a significant barrier for less developed communities[7,8]. Consequently, in Iran, financial losses from floods have increased in recent decades, with rural populations being the primary victims[9]. Communities with economies dependent on rain-fed agriculture are particularly vulnerable to flood damage[10]. This vulnerability is exacerbated in arid and semi-arid regions where, due to water scarcity, many villages are built along riverbanks, leading to substantial damage to rural inhabitants due to inadequate facilities[11]. Thus, rural areas, lacking adaptability and proper infrastructure, are more sensitive to floods, resulting in greater destructive effects[12–16]. Floods destroy livelihood resources, imposing long-term impacts on residents' lives. Sometimes, people are forced to abandon their areas and migrate to more favorable regions to restore their livelihoods[4,16,17].

While climatic and environmental factors primarily determine the severity of flood occurrence, the incidence of floods and their impacts on residents are linked to certain human-induced elements[10]. Therefore, the pursuit of novel and robust solutions for flood prevention and mitigation is of paramount importance[18]. Global disaster risk reduction policies have emphasized the significance of resilience and adaptation strategies[19]. Considering

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the highly variable and unpredictable nature of floods, it is imperative to enhance the capacity and resilience of residents to withstand and live alongside disasters[12]. To enhance the resilience and adaptation of rural households in coping with floods, the risk perception of individuals must first be considered as a crucial issue[20,21]. Risk perception can predict the extent to which vulnerable households are inclined to undertake precautionary measures against external threats and serves as a factor in exploring how to protect against natural hazards[20,22]. Households with a high perception of climatic risks are expected to exhibit greater adaptation capacity and disaster preparedness actions[23]. Hence, the rural-agricultural households' understanding level of flood risks influences their flood adaptation behavior, and the agricultural households' response to risk perception contributes to the development of appropriate public education and risk communication initiatives to reduce the adverse impacts of disaster hazards[24]. The escalating environmental, physical, social, and economic risks of floods highlights the continuous need for communities to adopt superior flood risk management approaches[16]. Accordingly, this study aimed to reduce flood risk by identifying the factors influencing flood risk perception in the flood-prone Khuzestan Province (southwest Iran).

Importance of Flood Risk Perception (FRP)

Climate change exacerbates flood risks, and the reduced capacity to cope with these risks makes managing the phenomenon increasingly challenging[25]. As a result, flood risk research has gained attention over the past decade, aiming to provide frameworks, approaches, and methods for modeling flood risk at the community level[26]. Many studies utilize the three main components of risk—hazard, exposure, and vulnerability—for flood management[27]. However, this vulnerability approach has primarily focused on damage to buildings and household livelihoods[28]. While this method provides a good understanding of the immediate damage impacts of a flood, it does not provide sufficient information for uncertainty propagation[29,30], risk-based decision making[31,32], and other types of analysis[33].

Other methods, such as multi-criteria decision-making (MCDM), have also been utilized in flood risk management evaluation[34,35]. Although these methods can quickly assess flood risk, they rely heavily on expert judgment, limiting the ability of local communities to respond effectively to the items[36,37]. Additionally, this method cannot consider different factors simultaneously, as it only performs the assessment and overlooks other aspects such as preparedness capacity and community decisions[32]. However, the FRP method not only examines local communities' understanding of floods[38]but also estimates individuals' preparedness for floods by assessing their knowledge and attitudes[39]. One of the key reasons that make FRP an effective method for dealing with floods is its ability to identify areas prone to flooding and the management methods for this phenomenon[40,41]. Therefore, in this study, FRP was utilized as an appropriate method in flood management to mitigate the effects of floods on rural areas.

Assessing risk perception is a critical issue, as evidence shows that it can significantly influence citizens' responses to flood events[42]. Therefore, evaluating the risk perception of communities can identify social elements that impact risk perception, enabling policymakers and disaster managers to prioritize programs and allocate resources effectively for the creation of appropriate prevention and resilience strategies[43]. By considering society's understanding of risk, FRP can be more effective[39]. A deeper examination of risk perception across various dimensions and levels demonstrates the social elements inherent in defining flood risk[44,45].

FRP has become an essential component of disaster risk management, comprehensively considering the social and natural processes associated with floods[46]. While risk analysis methods are generally based on objective criteria, subjective risk measures, such as risk perception, are now recognized as a vital part of flood risk management[44,45,47]. Individuals' behavior and attitudes help determine their level of preparedness; knowledge and awareness of risk are prerequisites for effective risk communication to enhance coping capacity and social resilience[48]. Risk perception can be examined from different perspectives, encompassing preparedness actions, including implementation of mitigation measures, coping capacity against floods, and a focus on resilience[49]. It was revealed that highly prepared individuals respond better to floods, leading to increased resilience and reduced consequences[50]. Since risk perception is based on subjective assessment of danger, people often resort to subjective judgment to assess uncertain hazards or perilous events. These judgments rely on the availability of existing knowledge, both personal and external, about a hazard[51]. Risk is subjectively perceived and conceived as a concept devised by humans to cope with life's uncertainties and hazards[52]. Historically, risk perception has been associated with feelings of anxiety, fear, nervousness, worry, or a sense of proximity to exposure to hazards, parallel to high perceived risk[53]. Furthermore, other indicators have added as markers of risk perception include voluntariness, controllability, risk distribution and benefits, trust in risk management, familiarity, personal experience[54], willingness, severity, origin, pattern of exposure, personal and environmental exposure, previous experience, adaptability, proximity to danger, and self-efficacy[55]. Additionally, judgment, individuals' emotions, values, and social inclinations[56], insurance, the severity of acute impacts, the capacity to cope with a shock, and similar factors are considered in this context[57].

Numerous studies have highlighted the importance of identifying the factors influencing FRP[58]within a community to achieve effective risk communication and enhance local community resilience against hazards[59]. Additionally, understanding hazards aids in the adoption of preventive measures and ultimately in reducing the impacts of floods[45,51]. Consequently, over the past few years, extensive research has been published on FRP, identifying various influencing factors[38,60,61]. For instance, Bradford et al.[59]investigated the relationships between awareness, concern, and preparedness using responses from 13 countries across Europe. Another study examined demographic factors influencing risk perception[42]. Other studies has focused on trust in experts or authorities and experience[62]. Further studies have explored economic, demographic, and educational factors[48].

Empirical literature review indicated that socioeconomic characteristics, farm-level factors, and institutional elements affect individuals' responses to flood events[40,41,63]. Some others have emphasized cultural factors[64], social position, and preparedness for protective actions[65]. Another study classified the factors influencing flood

Researchers	Iqbal and Nazir[39]	Semnan et al.[61]	Zaalberg et al.[69]	Bubeck et al.[68]	Poussin et al.[67]	Harish et al.[62]
Region	Pakistan	Australia	Netherland	Germany	France	Vietnam
Flood experience	*	*		*	*	*
Region characteristics	*	*	*	*		*
Flood risk commutation	*	*		*		

Table 1. Classification of factors affecting FRP.

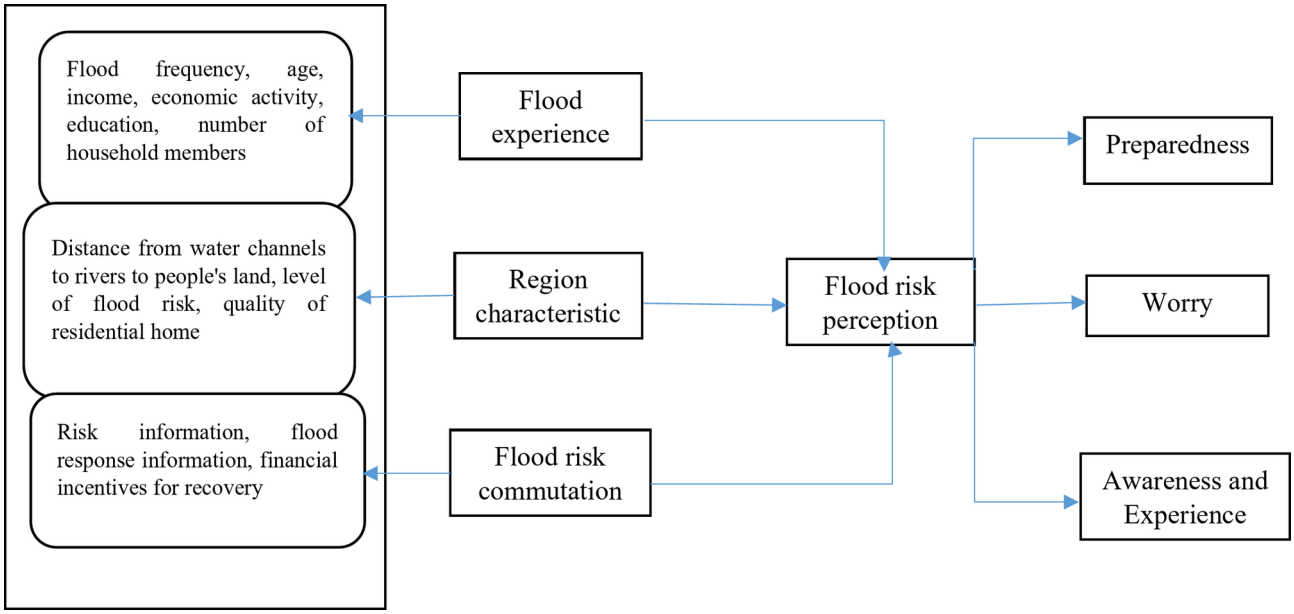

Fig. 1. Theoretical framework of the research.

risk perception into past experiences, health risks and diseases, and coping strategies[38]. Ultimately, various studies have summarized the factors influencing FRP in Table 1; Fig. 1.

Materials and methods

Study area

Shushtar County is one of the counties in Khuzestan Province that has been designed using Geographic Information Systems (GIS10.5) software (https://soft98.ir/software/engineering/3526-arcgis.html) (Fig. 2). But in the last few years, due to many floods, a large part of agriculture and rural households in this city have been destroyed. Rural-farmer households in this city suffer a lot of damage every year due to lack of knowledge and understanding of floods. Therefore, as a result of floods in the last few years, many villages in this city have been deserted. Therefore, it is necessary to investigate the effective factors in reducing the risk of flooding in this city so that the planners of this area can be helped to reduce the risk of flooding.

Statistical population and sampling method

The statistical population of this research included all rural households in Shushtar city. To estimate the sample size, Krejcie and Morgan[66] table was used. Accordingly, 400 rural household heads were selected for the study, using a proportional allocation for a stratified sample. Shushtar city has three sector: "Shoaibieh," "Central" and "Mianab." At first, it was tried to select two rural district from each sector, and finally, two villages from each rural district were selected for study.

Survey instrument

The primary tool utilized in this research was a comprehensive questionnaire comprising four main sections:

Flood Experience of Rural Households: This section captured variables such as the frequency of flood occurrences, age, income, economic activity, education, and family size.

Region Characteristics: This section measured variables related to the region, including the distance of water channels or rivers from individuals' properties, the level of flood risk exposure, and the quality of residential buildings.

Flood Risk Communication: This section focused on variables related to flood risk communication, including risk information, flood mitigation information, and financial incentives for recovery.

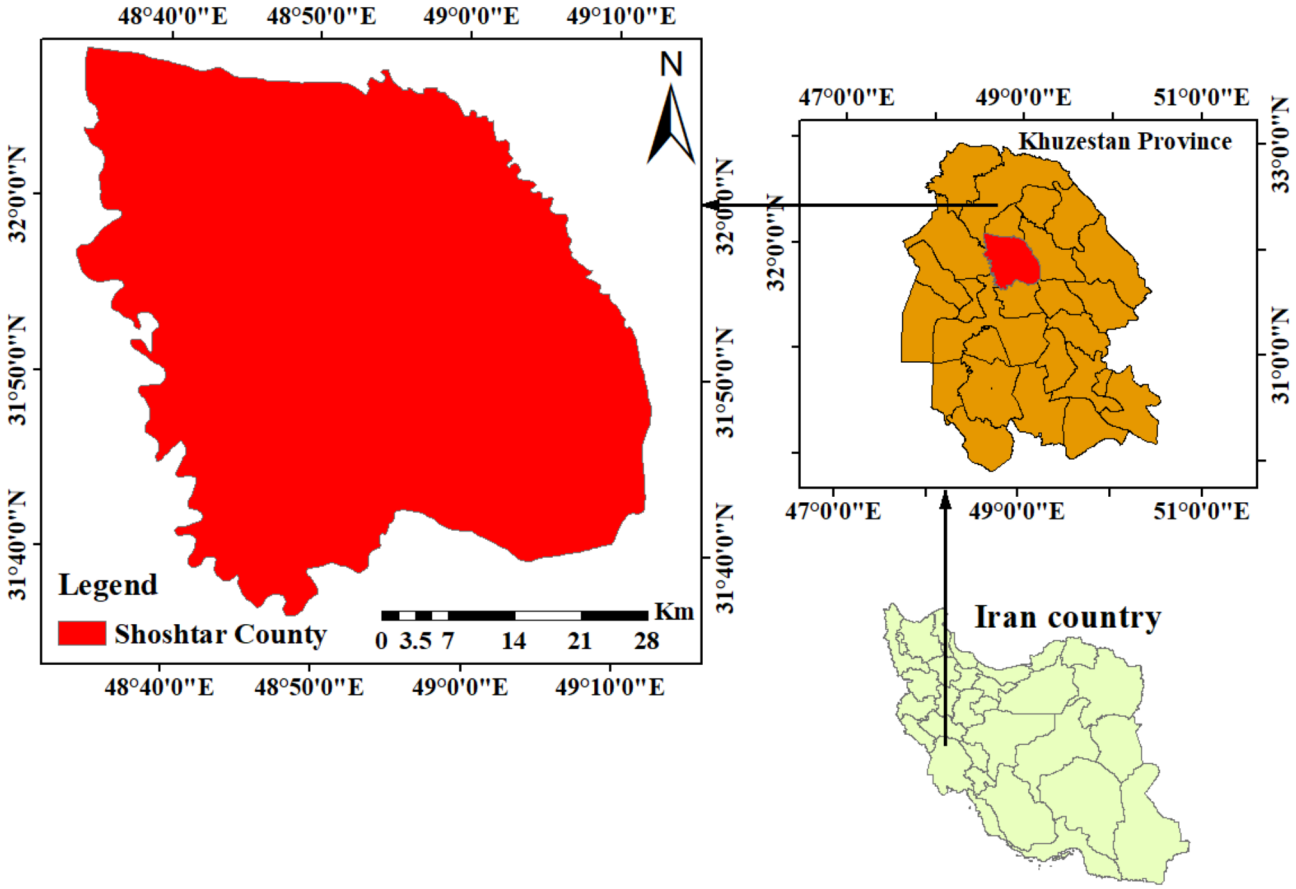

Fig. 2. Case Study.

Variable	Items number	Cronbach's alpha value
- Exposure level	4	0.83
- Preparedness	5	0.78
- Worry	4	0.86
- Awareness and Experience	3	0.74
- Financial incentives for recovery	3	0.82
- Information risk	3	0.85
- Flood mitigation information	5	0.81

Table 2. Estimated Cronbach's alpha values for variables.

Flood Risk Perception: This section assessed the dependent variable of the research, which is flood risk perception. It measured three dimensions of risk perception: preparedness, worry, and awareness and experience, which were used to measure this part of studies[48,57,58,67,68]. The research questionnaire is provided in the (Appendix A) section.

Reliability and validity

Before collecting data, the questionnaire was reviewed by experts in the fields of water, agriculture, and rural development. Based on their feedback, the necessary amendments were made. To estimate the reliability of the research instrument, Cronbach's alpha coefficient was used. The alpha values for all variables exceeded 0.7, indicating the questionnaire was reliable for this research. Specifically, the Cronbach's alpha value needed to be above 0.773 for all research items to confirm reliability. As shown in Table (2), all research variables met this criterion, demonstrating that the observable indicators were accurately selected to measure the latent variables with appropriate precision.

Ethical statement

Informed consent was obtained from all individuals who participated in the study. All materials and methods were carried out according to instructions and regulations, and this research has been approved by a committee at Agricultural Sciences and Natural Resources University of Khuzestan, Mollasani, Iran. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Data analysis

In this study, the Statistical Package for the Social Sciences (SPSS) version 26 software was used to analyze the data in two sections: descriptive and inferential statistics. The software can be downloaded from this link (downloaded from https://www.uhi.ac.uk/en/lis/software-downloads/spss-statistics-home-use/). In the descriptive section, statistics such as average, standard deviation, and coefficient of variation were utilized. In the inferential section, hierarchical regression was employed. Hierarchical regression indicated that the predictor variables significantly justified the changes in the dependent variable after introducing other variables. In comparison to statistical methods, this framework is better suited for comparative models[69]. With Hierarchical regression, it is feasible to determine the influence of multiple independent variables on a dependent variable across several steps[70]. In this method, the researcher predetermines the order of variables entering the analysis, in accordance with the study's theoretical or empirical framework. In other words, the researcher personally decides the order in which variables are introduced into the analysis. Also, this approach enables the researcher to analyze one or more variables simultaneously in each case[69].

Also, to determine the status of the FRP dimensions (preparedness, worry, awareness, and experience) among rural households, the median statistic was used. The median is the value that divides a statistical population or probability distribution into two equal parts. One key advantage of the median over the mean is that it is not influenced by extremely large or small values in the dataset[71]. Given that a five-point Likert scale (1- very little, and 5- very high) was used in this study, 3 theoretical medians were considered. Also, to classify and group the status of FRP components among rural households, the index of standard deviation from the mean (ISDM) was employed as follows[72].

Low: $A < Mean\text{-}\ \frac{1}{2}Sd.$

Medium: $Mean\text{-}\ \frac{1}{2}Sd < B < Mean\text{-}\ \frac{1}{2}Sd.$

High: $C > Mean+\ \frac{1}{2}Sd.$

Results

Individual characteristics of respondents

The average age of the respondents was 46.88 years, with a standard deviation of 11.88 years. In this study, 58% of participants were male, while the remaining 42% were female. An examination of the educational status revealed that nearly one-third of the participants had primary education (26.37%), and only a small percentage (10.88%) had university education. Additionally, the monthly income of the participants was 205.77 million Rials.

FRP grouping among rural-farmer households

The findings of the research showed that the studied rural-farmer households have significant concerns regarding flood risks. Their awareness and experience were also higher than the average level (theoretical median of 3). Despite this, their level of preparedness to deal with floods remains very low (Table 3). In addition, based on the ISDM index, it can be concluded that the rural households studied are highly concerned about the risk of flooding, yet they have low preparedness to deal with it. In addition, based on researchers' observations, many rural households acknowledged that the probability of flooding in the rural areas of Shushtar is high every year. Moreover, the government has not designed sufficient support and early warning programs for them. Rural households have reported that past floods were largely managed through the collective efforts of villagers, significantly impacting their livelihoods and assets. The frequent occurrence of floods has significantly reduced the resilience level of rural households in the study area. Consequently, the implementation of effective flood management measures is essential.

Investigating the relationship between research variables and FRP dimensions

Pearson's correlation was employed to investigate the relationship between research variables and FRP dimensions. The results indicated significant relationships between the following variables: age, frequency of floods, education, distance of water channels or rivers from individuals' properties, flood risk level, residential

Variables	Mean	Sd	ISDM Category		
			Low	Medium	High
Preparedness	2.88	0.631	190	155	55
Worry	4.33	0.775	21	103	276
Awareness and Experience	3.05	0.682	86	129	105
Flood risk perception	3.42	0.696	99	129	172

Table 3. FRP grouping among rural-farmer households.

Variables	Preparedness		Worry		Awareness and Experience	
	r	Sig	*r*	Sig	*r*	Sig
Frequency of flood occurrences	0.321	0.001	0.249	0.042	0.364	0.001
Age	−0.415	0.001	0.241`	0.023	−0.419	0.001
Income	0.032	0.105	0.101	0.059	0.002	0.162
Economic activity	0.041	0.318	0.060	0.315	0.041	0.412
Education	0.231	0.002	0.205	0.035	0.413	0.001
Family size	0.030	0.242	0.011	0.523	0.020	0.426
Distance of water channels	0.423	0.001	−0.588	0.001	−0.252	0.001
Level of flood risk exposure	0.253	0.012	0.366	0.001	0.505	0.001
Quality of residential buildings	−0.163	0.045	−0.305	0.001	0.422	0.001
Risk information	0.425	0.001	0.432	0.001	0.566	0.010
Flood mitigation information	0.523	0.001	−0.355	0.001	0.637	0.001
Financial incentives for recovery	0.202	0.001	−0.204	0.001	0.523	0.001

Table 4. Correlation between independent variables and FRP dimensions.

Model	*R*	R^2	Adjusted R2	R2 change	F change	Sig. F change
1[a]	0.537	0.328	0.317	0.328	30.668	0.003
2[b]	0.651	0.469	0.445	0.141	28.065	0.001
3[c]	0.0.680	0.586	0.554	0.117	27.072	0.001

Table 5. Results of the effective factors of FRP. [a] Predictors: Variables of flood experience. [b] Predictors: (See Model 1) + Variables region characteristic. [c] Predictors: (See Model 2) + flood risk commutation.

Variables	Unstandardized coefficients	Standardized coefficients	t	Sig
	B	Beta		
Frequency of flood occurrences	0.079	0.132	2.052	0.041
Age	−0.323	−0.149	−3.400	0.001
Income	0.007	0.012	0.190	0.850
Economic activity	0.280	0.035	0.598	0.550
Education	0.011	0.140	3.231	0.001
Family size	0.086	0.011	0.166	0.868
Distance of water channels	−1.374	−0.236	−3.774	0.001
Level of flood risk exposure	0.155	0.377	5.369	0.001
Quality of residential buildings	1.913	0.362	6.415	0.001
Risk information	1.516	0.240	4.102	0.001
Flood mitigation information	0.840	0.538	6.597	0.001
Financial incentives for recovery	0.321	0.637	5.391	0.001

Table 6. The final results of hierarchical regression of variables.

house quality, risk information, flood coping information, and financial incentives for recovery, with the dimensions of risk (preparedness, worry, and awareness and experience) (Table 4).

To investigate the effects of independent variables on FRP, hierarchical regression analysis was utilized. In the first step, flood experience variables were entered into the model, which explained 32.8% of the variance of the research's dependent variable (FRP). In the second step, these variables, along with region characteristics, were entered into the model, improving the prediction variance by 14.1%. In the third step, the variables from the second step were combined with flood risk communication variables, further enhancing the model's explanatory power by 11.7% (Table 5). Overall, the results indicated that the research components collectively explained 55.4% of the factors affecting FRP.

In addition, for a more detailed analysis, the results of the effect of each variable obtained from the simultaneous analysis of hierarchical regression are presented in Table (6). It is evident that out of the 12 investigated variables, only three—income, economic activities, and number of family members—did not have a significant effect on FRP. The remaining variables were found to have a significant effect in this context.

Discussion and conclusion

This research is one of the pioneering efforts in flood risk management, specifically examining the factors affecting FRP in southwestern Iran. The study aimed to identify the most significant factors influencing flood risk management to enhance the resilience of rural households. Consequently, this research can bridge the gap in the literature and support the peaceful coexistence of local communities in flood-prone areas. The results of this study indicated that factors such as flood experience, regional characteristics, and flood risk communication significantly impact FRP, explaining 55.4% of its variance. These findings align with previous studies[61,73–75]. The results for each factor were discussed in detail below.

The findings revealed that among the factors related to flood experience, the frequency of flood occurrences, age, and education significantly impact FRP. Variables in this section explained 32.8% of the variance in FRP. This result can be attributed to the observation that as the age of household heads in rural communities increases, their response to floods becomes slower and less accurate[45]. Additionally, due to lower educational levels among the elderly, many are unable to read early flood warnings and lack the necessary skills in this regard[55,76–81]. Furthermore, many elderly individuals are less likely to participate in educational and capacity-building programs related to flood management. Consequently, they are unable to implement coping strategies during floods[38]and are most vulnerable during natural hazards, often losing their livelihood assets. Another critical variable in this section is the frequency of flood occurrences, with findings consistent with previous studies[60,82–85]. Earlier studies have emphasized the importance of rural households' flood experiences in shaping their risk perception, suggesting that those who have experienced past floods and their damages consistently exhibit a high perception of flood risk[84,85]. Therefore, many hazards and associated concerns are dependent on individuals' personal experiences[85]. Direct experiences can evoke strong emotions, aiding in proper processing and analysis for management[4]. Emotional responses to hazards often correlate with the clarity with which individuals can imagine or experience negative consequences[86]. Personal experiences related to local weather and extreme climatic events can transform climate change from an abstract concept into a familiar, real, and immediate issue[87]. The third variable in this section, education, has been extensively highlighted in flood risk perception studies[84,88,89]. Education and awareness about factors influencing risk perception play a crucial role in adopting risk-reducing strategies and behaviors[90–92]. Understanding these factors aids decision-makers, policymakers, and rural planners in devising adaptive and resilient strategies to mitigate the destructive consequences of floods[20,93], thereby increasing public participation and the feasibility of risk-reducing programs[94]. For instance, Elshirbiny and Abrahamse[89] concluded that there is a positive and significant relationship between knowledge dimensions, causes and effects of climate change, and risk perception. In addition, the results indicate that the education level of most rural households in the study area is low, which reduces their level of preparedness against floods. Therefore, it is essential to hold flood preparedness training courses for these individuals.

The second set of variables influencing flood risk perception pertains to region characteristics, including the distance of water channels or rivers from individuals' properties, the level of flood risk exposure, and the quality of residential buildings. Various studies have highlighted the significance of these variables[38,60]. It was demonstrated that households living close to rivers and flood-prone areas or those with higher exposure to floods have a heightened perception of flood risks[45]. This increased awareness is because these individuals usually have firsthand experience with past floods and a comprehensive understanding of their destructive consequences[38]. Additionally, communities with deteriorated building structures and homes not constructed according to engineering principles exhibit a higher perception of flood risks. Consequently, individuals residing in substandard housing that is also vulnerable to flooding experience heightened vulnerability[60]. Therefore, it can be concluded that regional characteristics significantly impact individuals' resilience in coping with floods. Accordingly, Aboagye et al.[95] assert that people's understanding of the causes and effects of floods varies based on their location and level of exposure, influencing the strategies they employ for intervention. Hence, the outcomes and incidents of floods are unpredictable. To address this, it is essential to prepare the population by increasing their knowledge and awareness, understanding the risks, and disseminating guidelines on actions to take before and during flood events. This approach will enhance individuals' perception of hazards and encourage them to undertake preventive measures to minimize potential damage during flood disasters.

The third set of variables influencing FRP included flood risk communication variables such as risk information, flood mitigation information, and financial incentives for recovery. The findings from various studies are consistent with these results[38,60,74]. Previous studies noted that resilience in dealing with floods is a function of individuals' perception, awareness, and knowledge of the risk[38]. Since risk perception affects safety behaviors and resilience, strategies must be adopted to enhance individuals' resilience and resistance to hazards such as floods. Bodoque et al.[96]argue that improving resilience is linked to increasing individuals' awareness and understanding of risk. People with high concern about risks are more likely to feel prepared to confront the danger. The greater the awareness of the risk, the better prepared individuals are to take actions to mitigate negative outcomes, as knowledge has a direct effect on risk perception[97]. Risk information enables a better understanding of public perceptions, attitudes, and behaviors in relation to climate change, serving as an important foundation for government policy-making, developing strategies for service providers, and engaging local communities[98,99]demonstrated that risk knowledge has a strong positive effect on understanding the impacts of climate change. In other words, individuals with more knowledge about climate change better comprehend its negative impacts. Furthermore, knowledge about evacuation procedures and relocating to safe places can enhance resilience. Having an appropriate evacuation plan and good site selection can significantly assist rural households. Therefore, it can be concluded that risk knowledge and information among rural households can improve their resilience and reduce the impacts of floods. Another crucial variable in this context is economic incentives, which have been highlighted in various studies[40,41,63]. The studied rural households generally indicated that to enhance resilience and recover their livelihoods, they require economic and social support. Most of them lack substantial economic strength due to significant damage to their livelihood resources

from past floods. Communities with high levels of economic and social capital and trust-based relationships among individuals usually exhibit higher resilience in dealing with floods[41]. Economic incentives can facilitate individual adaptation; for instance, Paul & Routray[100] found that households with greater economic and credit access recovered from flood damages more quickly and were able to design more robust and safer homes based on engineering principles. According to the author's observations, the texture in many of the rural areas studied is outdated and lacks sufficient resilience to cope with flooding. Additionally, most of these rural areas are situated along river courses, highlighting the critical importance of flood management in these regions.

Policy implication

In this section, based on the research results, several policies were proposed to reduce the effects of floods on rural areas, so that while managing floods, sustainable livelihoods can be provided in rural areas.

Policy (i): Providing low-interest credit and facilities: Economic incentives, in addition to being important during floods, can also be an important preventive factor in reducing the effects of floods. Therefore, it is recommended that governments provide appropriate credit and facilities to facilitate the construction of residential houses based on flood-resistant engineering principles in rural communities.

Policy (ii) Development of knowledge and skills in flood management: It is recommended that workshops and training courses on flood management be organized for local communities, as many lack sufficient knowledge on how to mitigate and manage flood effects. Developing professional skills can thus provide a foundation for the resilience of rural households.

Policy (iii) Development of active organizations and NGOs: since effective flood response activities require the mobilization of local communities, it is recommended to establish local organizations to facilitate community participation in flood management.

Conclusion and limitations of the research

Conclusion

In general, it can be said that the risk of flooding affects more than 2 billion people worldwide, and climate change coupled with unplanned urban development will increase these risks. The impacts of floods on economies, communities, and people can be far-reaching. For example, in 2022, floods in Pakistan killed more than 1,700 people, affected 33 million people, and caused more than $39 billion in damage and economic losses. In the same year, Nigeria and Australia were also affected by devastating floods. In Iran, various parts of rural communities are affected by floods, and due to their low adaptive capacity, they are significantly impacted by this phenomenon. Effective flood management, therefore, requires extensive information in the field of FRP. This study was conducted with the overarching aim of determining the factors influencing FRP in Iran. The results indicate that rural households experience high levels of concern about flooding but are not adequately prepared to cope with it. In addition, the results showed that between the variables of age, frequency of floods, education, distance of water channels or rivers from people's property, flood risk level, residential house quality, risk information, flood coping information and financial incentives for recovery with dimensions risk means preparedness, worry and awareness and experience has a significant relationship.

To better manage these risks and build more resilient communities, detailed and accurate flood hazard and flood risk maps are essential.

Flood hazard maps identify areas affected by floods of different probabilities. They provide valuable information about the predicted flood depth and flow velocity. Flood risk maps, meanwhile, present the potential impact of floods on human health and life, economic activity and infrastructure, cultural heritage and the environment. The maps are a key instrument for integrated flood risk management. They are an important tool for raising awareness about areas at risk of flooding and for helping communities develop strategies for reducing these risks through structural and non-structural measures. Civil protection and first responders can use the maps to plan emergency response and the insurance industry refers to the maps and the underlying data to design flood insurance products. The maps are also essential for land-use planning and urban development to avoid creating new risks.

Research limitations

Despite its significant results, this study had three limitations. Limitation (i) The variables in this study accounted for 55.4% of the variance in factors affecting FRP. While this is a high and acceptable amount, a significant portion of the variance remains unidentified. Therefore, to enhance the explanatory power of this model, future research should identify other important variables and incorporate them into the framework of this study. Limitation (ii) We used only a quantitative paradigm in this study. It would be beneficial for future research to incorporate qualitative paradigms such as phenomenology, to examine the successful and unsuccessful experiences of rural households in flood control, and grounded theory, to identify obstacles to effective flood management. Utilizing qualitative approaches will lead to deeper and more comprehensive research results. Limitation (iii) refers to the research samples. In this study, households that suffered the most damage from the flood participated, but it would be better to include households that were able to take protective measures and maintain their resilience in flood conditions in future research so that the factors that separate these two classes can be investigated through logistic research.

Data availability

Due to data protection and participant confidentiality concerns, datasets generated during and/or analyzed during the current study are available from the corresponding author upon request.

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Author contributions

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Declarations

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The authors declare no competing interests.

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Additional information

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