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Psychological distancing and floods risk perception relating to climate change in flood-prone Bait communities of Punjab, Pakistan

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Abstract

Floods frequency and intensity due to severe climate change have increased which generally raised global destruction of resources and livelihood severity particularly the population inhabited in flood-prone areas. Pakistan is among the most climate change affected countries having long history of floods incidence, faced major losses of lives and economic resources. Hence, it is crucial to be aware of flood risks and having climate change perception for developing adaptation strategies of climate change and feasible measures of flood risk reduction. Psychological distance and flood risk perception relating to climate change in flood-prone Bait areas of Punjab was investigated in this study. Awareness, worry and preparedness to flood were three major indicators to quantify perception of flood risk whereas uncertainty, temporal, social, geographical and psychological as five dimensions applied to measure psychological distance. This research work used the sample data of 398 flood-prone respondents and applied the Pearson's correlation, ANOVA test and chi-square test for empirical estimation of the study. Empirical estimates illustrated as in general flood risk perception and psychological distance related to climate change in high flood risk areas were moderate whereas in worry and uncertainty negative association was estimated. Home ownership illustrated positive and significant affect on flood risk perception whereas negative influence on psychological distance to climate change in the estimates of regression analysis. Climate change adaptation and disaster risk reduction philosophies can put together through facilitation of this study. Risk communications strategies need to develop to facilitate inhabitants to understand impacts of climate change, application of precautionary strategies and flood risks lessening measures.

Keywords Adaptation strategies · Awareness · Mitigation measures · Natural disasters · Preparedness

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1 Introduction

During the current couple of decades, climate change has raised the occurrence of natural disasters more particularly the cyclones, earthquakes, droughts, landslides and floods (Ahmad & Afzal, 2022; Eckstein et al., 2019; Hoq et al., 2021; Week & Wizor, 2020), owing to rising climatic variations (Teo et al., 2018; Houng et al., 2019; Elahi et al., 2021). In perspective of other natural disasters, floods measured most consecutive and destructive (Cetin et al., 2021a; Daniell et al., 2016; Tirivangasi, 2018) because of considerable concerns regarding social risks, economic sufferers and human losses (Awan & Bilgili, 2022; Huong et al., 2019; IPCC,[1] 2017; Kreft et al., 2016). In global aspect, in 2017 almost the population of 96 million was sternly exaggerated by natural disasters (Mahmood & Babel, 2016; World Bank, 2021; Varol et al., 2022) from which about 60% was severely influenced by flood catastrophic (Ahmad and Afzal, 2021a; IPCC, 2020). Generally in the duration of current decades, South East Asian and South Asian countries deal with recurrent and severe floods (Aksoy et al., 2022; Emergency Event Database, 2017; Teo et al., 2018) where a few Asian countries India, Pakistan, China and Bangladesh stated the superstores of flood adversity (Abbas et al., 2017; Ahmad et al., 2023; Eckstein et al., 2019). Flood hazards growing severity and intensity are anticipated in south Asian region in upcoming eras (Hirabayashi et al., 2013; Sam et al., 2021) which accordingly influences regional discrepancy about beginning and allocation, reason to rising losses mount up in nations surrounded by the Asian region (Ali and Erenstein, 2017; Cetin et al., 2021b; IPCC, 2020; UNSCCC,[2] 2021).

In worldwide perspective, Pakistan is placed in critical area and facing recurrent floods which categorized this country the 5th mostly climate change influenced country in the world (Eckstein et al., 2019; IPCC, 2020). Erratic rains, glacier melting and long-drawn-out regular change of monsoon rainfall are few substantial factors related to repeated floods in interlinked rivers about downstream and upstream (Abid et al., 2015; Ahmad and Afzal, 2021b; Teo et al., 2019). Considering the flood disasters aspect, Pakistan constantly confronted twenty-two stern flood hazards from 1950 to 2014 (Abbas et al., 2017; Ahmad et al., 2019; Yaqub et al., 2015). In 2010, Pakistan confronted the most horrible flood disaster of the country's history which reasoned collective estimated cost of $10 billion, damaged two million cropped areas and harmfully affected 24 million populations (Ahmad and Afzal, 2022; Shah et al., 2017). Sindh and southern Balochistan regions in 2011 faced sever flood because of confirmation high erratic rainfall which rigorously affected the population of 2.7 million, ruined 6.79 million acres crops, destroyed 1.52 million homes and caused fatalities of 434 peoples (United Nations, 2011; PDMA[3] Punjab, 2017). In 2012, heavy monsoon rains in Punjab, Balochistan and Sindh reasoned fatalities of 571 peoples, drastically affected 4.85 million population and cropped area destruction of 1.172 million (PDMA Punjab, 2018). Heavy monsoon rains in 2013, consequently raised flash floods which caused destruction of 1.6 million acres cropped area, affected 1.5 million people and 234 human lives losses (BOS[4] Punjab, 2018). In 2014, major rivers flash flooding affected Punjab, Kashmir and Gilgit-Baltistan which consequently destroyed cropped area major home destruction and fatalities of 350 peoples (PDMA Punjab, 2019).

1 Intergovernmental Panel of Climate Change.

2 United Nations Security Council and Climate Change.

3 Provincial Disaster Management Authority.

4 Bureau of Statistics.

Punjab province is mostly well-known the five rivers fertile land such as Chenab, Indus, Jhelum, Sutlej and Ravi which are consecutively flowing throughout the province area (BOS Punjab, 2020; PBS, 2021). Chenab and Indus are main rivers of Pakistan (PBS, 2021) which are reason of recurrent floods disasters in summer owing to tremendous snow melting of glaciers and severe erratic rains because of extreme variations in climate change (IPCC, 2020; PMD,[5] 2019). In routine natural curving successions, these rivers are spread in diverse temporary waterways inland while passage in the route of different areas as provisional islands is normally give rise in the areas of river. In southern Punjab region, these provisional islands in the rivers recognized as area of Bait[6] in Saraiki local language. Rural population particularly inhabited in neighboring to such areas of river more often settled and carries out their agricultural in these areas of islands. In the season of flooding, these Bait areas are in straight fire of rivers. In floods and rainy season, these Bait inhabitants have confronted with devastation of infrastructure, crops, human fatalities, shelter damages and livestock losses. In the region of southern Punjab, consecutive flowing of Indus River has simultaneously raised flood hazard vulnerability (NDMA, 2018; PDMA Punjab, 2019). Livelihood of Bait farmers has severely affected by recurrent floods due to lacking of flood hazards improvement strategies. Inadequate provision of resources regarding hazards mitigation strategies, inadequate communications and awareness with fractional role of hazards authorities are a few considerable feathers linked to vulnerability of these southern Punjab Bait communities.

In global perspective, recorded weather pattern and rigorous temperature are for the reason of climate change which consequently increasing extreme consecutive flooding and rising sea level (Zeren-Cetin & Sevik, 2020; Ahmad et al., 2021a). In combating this climate change issues with adoption of mitigation measures, societal transformation play major role (Cetin, 2015b; Spence et al., 2012). Appropriate people's perception perceptive about climate change is necessary for proper public engagement where research aspect perceived climate change as distant (Cetin, 2016). Correlation in people's behavior and psychological distance is illustrated in contractual theory (Jones et al., 2017; Lorenzoni and Pidgeon, 2006; Loy and Spence, 2020). Temporal, spatial, hypothetical and social are distant four dimension of psychological distance which have cognitive separation in self and other instance such as persons, events and time (Chu and Yang, 2018; Kaya et al., 2019; Trope and Liberman, 2010). In climate change perspective such as someone perceives climate change psychological close himself having higher possibility to understand it concretely and eager to take measures (Singh et al., 2017; Spence et al., 2012). Furthermore, if climate change distant risk has efficiently conversed, climate change disastrous effects are imperatively underlined (Chu and Yang, 2020; Zeren-Cetin et al., 2020). Management of flood risk considered significant part of disaster risk management which broadly considered societal and natural progression correlated to floods (Cetin et al., 2018; McGahey, 2009). Method of risk investigation is usually related to aimed procedures, dealings of subjective risk like perception of risk which are presently being recognized as vital in perspective management of flood risk (Brown and Damery, 2002). Discrepancy constantly remains in public risk perception and experts risk assessment whereas in formulating the effective flood risk management policies relevant authorities needs to appropriate understanding of public risk perceptions (Bakri et al., 2015; Cetin, 2015a). People's attitude and their

[5] Pakistan Metrological Department.

[6] Temporary islands are usually generated within the area of the river in the local language Saraiki is formally known as *Bait*.

behavior facilitate in influential public preparedness level regarding certain risks (Jones et al., 2017). Inhabitant's perception of knowledge makes capable researchers to recognize qualitative feathers of risks which are identified to science, voluntary, immediate and out of control (Loy and Spence, 2020). Furthermore, risk perception familiarity is necessary to effective risk communications such as for increasing social resilience and enhancing coping capacity (Hillson and Murray-Webster, 2004). Perception limited understanding might influence risk communication which consequently cause the risk management strategies failure (Baan and Klijn, 2004; Jonkman et al., 2008).

In literature, flood risk perception perspective addressed with various scenarios such as some studies discussed the aspect of human belief simulated with prominent influence on risk perception concerning the flood hazards (Kellens et al., 2011; Kellens et al., 2011; Becker 2007; Lechowska, 2018), limited research work illustrated perception of upcoming floods likelihood, its sources, shocks and actions about floods and human behavior (Bubeck et al., 2012; Spitalar et al., 2014; Cole et al., 2016; Diakakis et al., 2018) whereas some significant studies highlighted the behavior influence related to insurance adaption, mitigation actions and perception of flood risk seeking information (Rowe & Wright, 2001; Werritty et al., 2007; Pagneux et al., 2011; Terpstra and Lindell, 2013; Wachinger et al., 2013; Ryan, 2013; Knuth et al., 2014). Psychometric perspective also focused in some research studies concerning flood hazards experience and demographic feathers. Such aspect in some studies showed the past submerge as forecaster of future behavior, consciousness and perception of risk likelihood (Fischhoff et al., 1978; Terpstra and Gutteling, 2008; Lopz-Marrero & Yarnal, 2010; Terpstra and Lindell, 2013; Poussion et al., 2014; Birkholz et al., 2014; Cetin, 2019). Floods perception regarding mitigation measures, constrains and causes particularly discussed in many significant studies (Jonkman & Kelman, 2008; Lopez-Marrerro & Yarnal, 2010; Birkholz et al., 2014; Verlynde et al., 2019), local communities flood risk management (Paul & Routray, 2010; Wilby & Keenan, 2012; Ahmad and Afzal, 2021a) and flooding risks adaptation (Wisner et al., 2014; Osberghaus, 2015, Ahmad et al., 2021b). In some significant studies, the perception of flood risk and preparedness is elaborated (Birkholz et al., 2014; Boholm, 1998; Bradford et al., 2012; Bubeck et al., 2012; Burn, 1999; Kellens et al., 2011; Khan et al., 2021; Lechowska, 2018; Ludy and Kondolf, 2012; Pagneux et al., 2011; Raaijmakers et al., 2008; Raška, 2015; Slovic, 2000; Terpstra, 2010; Veen and Logtmeijer, 2005; Wachinger et al., 2013; Weinstein, 1989) whereas the perspective of psychological distance to climate change also indicated in many studies (Chu and Yang, 2018, 2020; Jones et al., 2017; Lorenzoni and Pidgeon, 2006; Loy and Spence, 2020; Singh et al., 2017; Spence et al., 2012; Trope and Liberman, 2010).

In Pakistan, there exists the limited research work about flood risk perception which mostly focused the factors influencing the flood risk perceptions, attitudes and mitigation measures (Ahmad and Afzal, 2021a; Ahmad et al., 2021a; Fahad and Wang, 2018; Khan et al., 2020; Rana and Routray, 2016; Rana et al., 2020; Ullah et al., 2020). In Pakistan and more particularly in the Punjab Bait areas, the research area of psychological distance and perception of flood risk related to climate change yet not addressed in existing research literature. In finding out this research gap and realizing the significance of this research aspect, the given study tried to elaborate this research perspective. This research work contributed in existing literature with three specific objectives firstly investigate the psychological distance and perception level of flood risk related to climate change in flood-prone *Bait* inhabitants of the study areas, secondly examine the feathers influencing psychological distance and perception level of flood risk related to climate in study area and lastly, investigate empirical association in psychological distance and perception level of flood risk related to climate change. The study is classified in to five segments as introduction

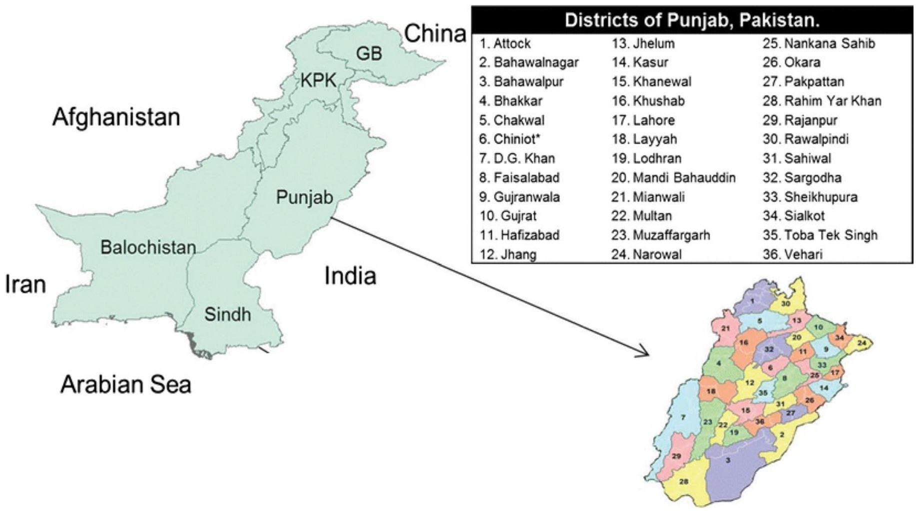

Fig. 1 Map of Pakistan provinces and Punjab districts

illustrated in the first segment and segment two discussed the material and method. In the third segment, empirical estimates are indicated, and discussion section is elaborated in fourth segment whereas last segment highlighted the conclusion and suggestions of the study.

2 Material and methods

2.1 Selection of study area

Pakistan, having an agrarian economy with population of 207.8 million and covers the area of 796,096 km^2 (PBS, 2017), consists four provinces Sindh, Khyber Pakhtunkhwa, Balochistan and Sindh (PBS, 2021). Punjab was highly favored and chosen for the study owing to some significant reasons first of all, Punjab covering the 26% area, sharing the population 52.95% and contributing 53% in agriculture GDP[7] of Pakistan (BOS, Punjab 2020; PBS, 2021) as geographical perspective illustrated in Fig. 1.

Secondly, Punjab rather than other provinces confronted with consecutive severe floods adversity in the reason of consecutive flowing of country's main five rivers from the plain and fertile lands of province (NDMA, 2018; PDMA Punjab, 2019). Thirdly, southern region of Punjab province is mainly favored for this research because of repeatedly confronted flood disasters and placed western and eastern bank of leading and most flood destructive river Indus (NDMA,[8] 2018; PBS, 2020). Fourthly, Bait communities of southern Punjab region were mainly listed carefully the reason of that such population generally inhabited in these provisional islands of distributive riverine channels of Indus river and generally betrothed in activities of farming. In particular, Bait inhabitants targeted in

[7] Gross Domestic Product.

[8] National Disaster Management Authority.

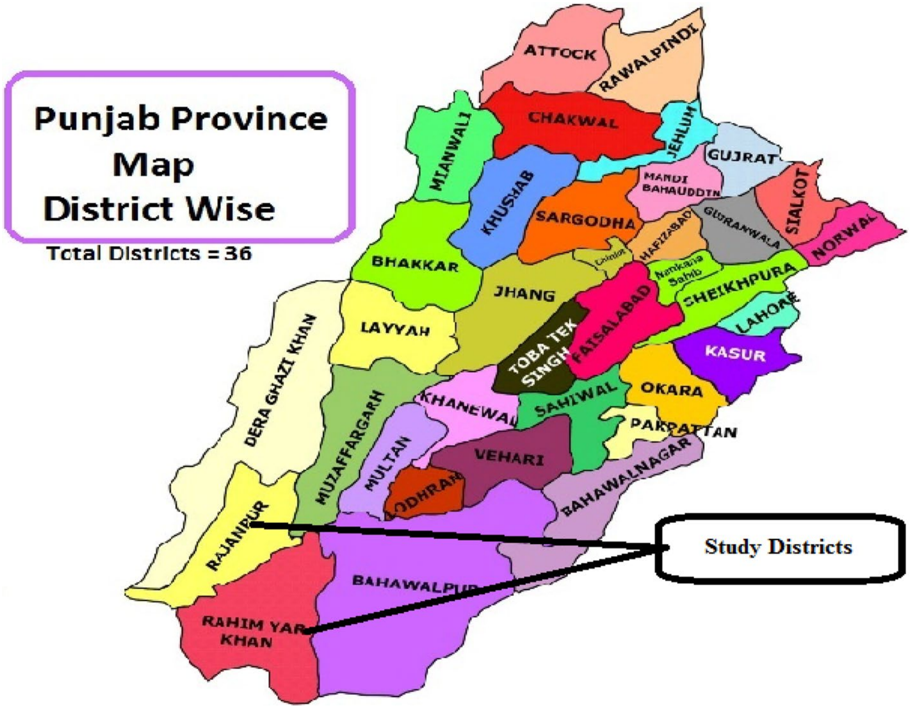

Fig. 2 Study districts of Punjab province of Pakistan

this research work the reason of that repeated floods directly hit these communities and enhances their vulnerability of farming participation. Last of all, in highly severe flood risk seven Bait areas districts, two most severe flood risk Bait areas districts Rahim Yar Khan and Dera Ghazi Khan were selected for this research work as Fig. 2 illustrated it.

2.2 Study area geographical feathers

Rahim Yar Khan consists 11,880 km^2 area and having 4,814,006 population (PBS, 2017). Liaqatpur, Rahim Yar Khan, Khanpur and Sadiqabad are administratively categorized district Rahim Yar Khan four tehsils situated on Indus River eastern bank and high vulnerable and frequently influenced from tremendous floods (GOP, 2019). The reason of intense and long summer, this district is known hot area by rising standard temperature 36.2 °C (Pakistan Meteorological Department (PMD), 2019). Cholistan desert also located in Rahim Yar Khan district officially recognized in local language *Rohi* and extended all through the division of Bahawalpur whereas as of total the Cholistan covers almost 1/4 district area (GOP, 2021). Rahim Yar Khan economy is mostly agro-based where common population (65%) allied with main occupation of agriculture (BOS Punjab, 2020) whereas facing repeated flooding for the duration of couple decades owing to climatic dynamics and confronted with main destruction of infrastructure, livestock, human fatalities and crops (PDMA Punjab, 2014).

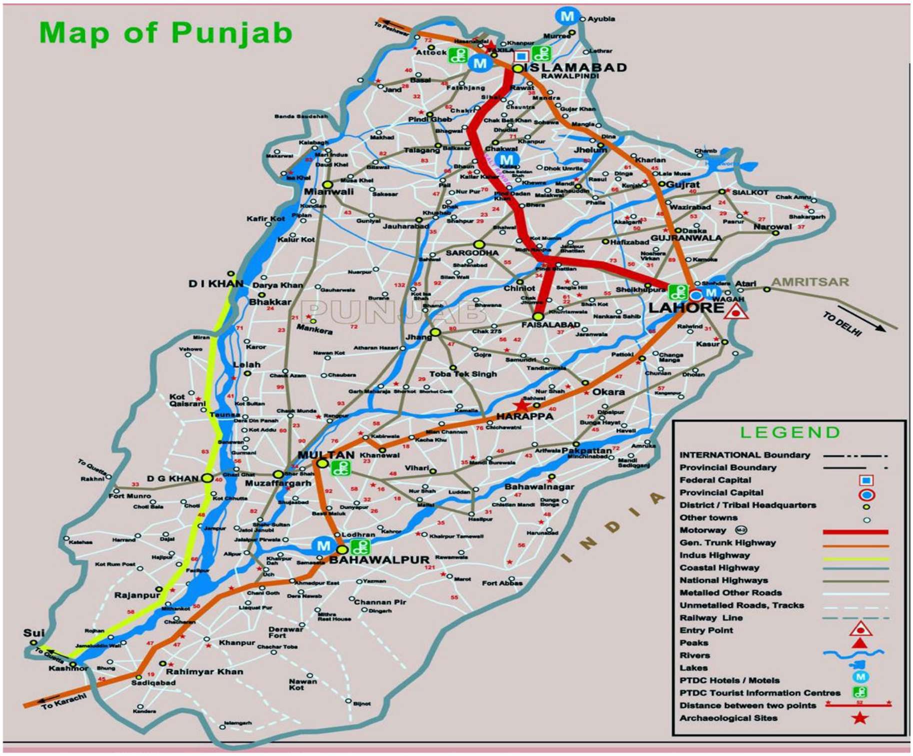

Fig. 3 Study districts Rahim Yar Khan eastern and Rajanpur western bank of Indus river flows

District Rajanpur is administratively classified into three tehsils Jampur, Rajanpur and Rojhan having 69 union councils with 1.99 million population and 12,318 km^2 area (GOP, 2017; PBS, 2020). Rajanpur having hot and long summer season and mild winter whereas 52 °C highest temperature and 1 °C lowest one yet having 119 mm average rainfall (PMD, 2019). In aspect of facing frequent and consecutive flood hazards district considered higher vulnerable and situated on the Indus river western bank showing critical geographical picture (GOP, 2019). Indus River repeated flooding in district flood-prone areas major factors of human fatalities, livestock losses, destruction of crops and infrastructure (PDMA Punjab, 2018). In the scenario of critical cultural, economic and social dimensions with social progress index lower value Rajanpur in the province considered lowest socioeconomic area (GOP, 2019). In Fig. 3, both districts geographical location is particularly portrayed.

2.3 Data collection and sampling method

In this research work, random sampling approach was applied for data collection firstly; on the basis of floods higher vulnerability from each district, two tehsils were chosen while from each tehsil two union councils were selected related to provided information given by the land record local officer (patwari), DDMA[9] and agriculture officer. Lastly, in the sequence of destruction and vulnerability of flood hazards, two villages from each union council of Bait communities were selected whereas in each one village sixteen respondents were interviewed and randomly selected. In random sampling method, every individual have equal chance in selection which reduces the survey selection biases and capable to calculating errors of sampling. In sample selection, different approaches were used in literature whereas Yamane (1967) sampling approach was applied in this study as indicated in Eq. (1).

$$Sample\ Size = \frac{N}{1 + N(e)^2} \tag{1}$$

In above mentioned equation, population size indicted as N while precision level illustrated in as e. Applying the 95 percent confidence level and precision level 10 percent, this sampling approach proposed sample size 398 which was collected by using random sampling approach in the study area. Study area respondents were directly linked; pre-tested and finally improved questionnaire was applied for collection of data from August to November 2020. Relevant to adequacy and accuracy of particulars, moreover escaping ambiguity such questionnaire was used related to pilot research work and by 28 flood-prone inhabitants was pre-tested prior to preliminary the proper survey. In such aspect, author and four skilled enumerators make clear and accurate all correlated issues concerning questionnaires earlier than commencement the practice of data collection in the study area. Respondents in the study area were appropriately well-versed about the use and reason of data collection; those respondents who say no to put in their particulars were replaced to leftover respondents.

2.3.1 Questionnaire design and selected indicators

In viewing the comprehensive review of literature about climate change and flood risk procedure, indicator selection was finalized as indicated in Tables 1 and 2. Questionnaire was designed in the sequence of these indicators for measuring the particular variables as uncertainty, temporal, social, geographical distance, awareness, worry, preparedness and psychological distance. Indicators which applied in the study were on the basis of Likert scale 5 point which indicated the highest value 5 and lowest value 1. For maximum participation and encouraging the respondents, questionnaire was translated from English to Urdu language those who were illiterate asked questions in Urdu and local language Saraiki for their ease to understandings and proper response.

In the selected Bait communities study areas each indicator descriptive statistics was used. ANOVA and Chi-square test were applied to analyzing the difference in perception of flood risk and psychological distance to climate change about Bait communities of the study areas. In these both Bait communities, relevant indicators were grouped as psychological distance five dimensions and flood risk perception three components to climate change. In literature, different studies applied weighted average index approach whereas by application of Eq. (2) index value was determined (Rana & Routray, 2018).

In contrast to general perception of flood risk and psychological distance to climate change in these both Bait districts communities, these estimated values were analyzed. In

[9] District Disaster Management Authority.

Table 1 Dimensions and indicators for assessing psychological distance to climate change

Dimensions	Statement of question asked	Cited studies	Measurement unit	Expected response
Psychological				
Psy1	You understand climate change responsible for floods at what extent?	Botzen et al. (2009), Wouter Botzen and Van Den (2012)	[b]Likert scale 5-points	High/highest level
Psy2	You understand floods because of human involvement at what extant?	Wachinger et al. (2010)	Likert scale 5-points	Low/higher level
Psy3	Whether climate change possible to quantify?	Spence et al. (2012)	Likert scale 5-points	Low/higher level
Geographic				
Geo1	Climate change likely affected my local area	Spence et al. (2012)	Likert scale 5-points	High /highest level
Geo2	Developing countries will mostly affected by climate change	Spence et al. (2012)	Likert scale 5-points	High /highest level
Geo3	Far away areas from here will mostly affected from climate change	Spence et al. (2012)	Likert scale 5-points	Low/higher level
Social				
Soc1	Peoples likely higher impacted by climate change	Spence et al. (2012)	Likert scale 5-points	High /highest level
Temporal				
Tem1	At the level Pakistan having the effect of climate change	Spence et al. (2012)	Likert scale 5-points	High /highest level
Tem2	Peoples see climate change direct threat	McDonald et al. (2015)	Likert scale 5-points	High /highest level
Tem3	Climate change effect have personally experienced by peoples	McDonald et al. (2015)	Likert scale 5-points	High /highest level
Tem4	People understanding climate change effects future generations	McDonald et al. (2015)	Likert scale 5-points	High /highest level
Uncertainty[a]				
Unc1	Uncertainty relays to me regarding climate change happening	Spence et al. (2012)	Likert scale 5-points	Low /higher level

Table 1 (continued)

Dimensions	Statement of question asked	Cited studies	Measurement unit	Expected response
Unc2	Climate change seriousness is exaggerated	Spence et al. (2012)	Likert scale 5-points	High /highest level
Unc3	Climate change caused by human as mostly scientists agreed	Spence et al. (2012)	Likert scale 5-points	High /highest level
Unc4	What will climate change effects thescenario is uncertain	Spence et al. (2012)	Likert scale 5-points	Low /higher level
Unc5	Among scientist regarding aspect of climate change no unified opinion	McDonald et al. (2015)	Likert scale 5-points	Low /higher level

[a]Inversed to scale

[b]Likert scale: 1 = Lowest level, 2 = Low level, 3 = High level, 4 = Highest level, 5 = Extreme level

Table 2 Dimensions and indicators for flood risk assessment

Dimensions	Questions or statements asked to respondents	Cited studies	Measurement unit	Expected response
Preparedness dimensions				
Pre1	At what level you believe you are equipped for flood hazards?	Zaalberg et al. (2009)	[a]Likert scale 5-points	Lowest /lower level
Pre2	At what level you communicated your family about flood hazards readiness?	Becker (2007)	Likert scale 5-points	Lower/higher level
Pre3	How a great deal in future you are keen to look for information regarding flood hazards?	Becker (2007)	Likert scale 5-points	Lowest/lower level
Pre4	What you understand regarding your capacity to manage without external support?	Terpstra et al. (2008)	Likert scale 5-points	Lowest /lower level
Pre5	What are the possibility of assure your assets, family and yourself?	Becker (2007)	Likert scale 5-points	Lowest /lower level
Pre6	Having probability your house to flood proofing?	Becker (2007)	Likert scale 5-points	Lowest /lower level
Pre7	How greatly you are eager to take part in training programmes of floods?	Becker (2007)	Likert scale 5-points	Lower /higher level
Pre8	How a lot you think regarding protocols of early warning?	King, (2000)	Likert scale 5-points	lower/higher level
Pre9	What is your trust level regarding government measure?	Rana et al. (2020), Yu et al. (2013)	Likert scale 5-points	Lowest/lower level
Pre10	What is your trust level on media?	Yu et al. (2013)	Likert scale 5-points	Higher/highest level
Pre11	How greatly you are keen to take on measures of flood preparedness related to your house?	Becker (2007)	Likert scale 5-points	Higher/highest level
Worry dimension				
Wor1	What is your level of anxiety regarding floods?	Ho et al. (2008), Miceli et al. (2008), Qasim et al. (2015)	Likert scale 5-points	Highest/extreme level
Wor2	In your area if flood happen what are lives losses chances?	Ho et al. (2008), Miceli et al. (2008)	Likert scale 5-points	Highest/extreme level
Wor3	What level damages your personal health can face due to floods?	Miceli et al. (2008), Siegrist and Gutscher, (2006)	Likert scale 5-points	Higher/highestlevel

Table 2 (continued)

Dimensions	Questions or statements asked to respondents	Cited studies	Measurement unit	Expected response
Wor4	What issues of social environment (disruption of communication, transportation and schools) can occur due to floods?	Mehta and Smith (2013)	Likert scale 5-points	Highest/extreme level
Wor5	At what level houses (damaged walls, wet floor, belonging sweeping away) can damaged by flood?	Terpstra et al. (2008), Qasim et al. (2015)	Likert scale 5-points	Highest/extreme level
Wor6	At what level flood can disturb food security (famine, livestock loss, food supply disruption)?	Miceli et al. (2008)	Likert scale 5-points	Higher/highest level
Wor7	To what level, flood can damage utility services (sanitation and water supply)?	Miceli et al. (2008), Takao et al. (2004)	Likert scale 5-points	Highest/extreme level
Wor8	To what level likelihood your lifestyle will change due to flood?	Armaş and Avram (2009), Rana et al. (2020)	Likert scale 5-points	Higher/highest level
Experience and awareness				
E&A1	At what level in your area you aware about evocation routs during flood?	Wisner et al. (2014), Rana and Routray (2016)	Likert scale 5-points	Lowest/lower level
E&A2	What is your awareness status regarding emergency protocols?	Hosseini et al. (2014), Wisner et al. (2014), Rana and Routray (2016)	Likert scale 5-points	Lower/higher level
E&A3	At what level you know flood warning and forecasting?	Ahsan and Warner (2014)	Likert scale 5-points	lowest/lower level
E&A4	What level you conscious extraordinary weather pattern (changing rainfall pattern, higher temperature)?	Bichard and Kazmierczak (2012), Działek et al. (2014)	Likert scale 5-points	Highest/extreme level
E&A5	At what level flood occurrence possibility in your area?	Terpstra et al. (2008), Ho et al. (2008)	Likert scale 5-points	Highest/extreme level

[a]Likert scale: 1 = Lowest level, 2 = Low level, 3 = High level, 4 = Highest level, 5 = Extreme level

determining the relationship among psychological distance dimensions to flood risk perception and climate change, Pearson correlation approach was applied.

$$CI = \frac{w_1 + w_2 + w_3 + \dots w_n}{n} \tag{2}$$

$$\mathrm{CI} = \frac{\sum_{i=1}^{n} wi}{n} \tag{3}$$

Moreover, two OLS regression models were also applied for estimation the indicators of socioeconomic to regress with psychological distance to flood risk perception and climate change. Flood experience, monthly income, homeownership and age were significant factors as included in the study. Null hypothesis was rejected in the study due to less than significance level *P* value that illustrated as dependent variables changes linked with independent variable variance.

3 Empirical estimates

Socioeconomic descriptive statistics of the study area illustrated in Tables 3 and 4, indicating as majority of the respondents households 30.15% are in the age of 41–50 years whereas 62.81% household heads are fully employed and 29.65% unemployed. Mostly respondents 30.65% have five years schooling whereas limited number 2.51% have higher schooling above 14 years. Livestock and agricultural farming consider major 60.55% source of livelihood in the study area while only limited households 4.77% having industrial sector participation. In the study area, significant population 38.19% having the marginal income pattern from PKRs 15,000–30,000 per month whereas mostly household respondents were having their own houses as majority inhabited households having length of stay from 20 to 30 years.

3.1 Climate change psychological distance

People's behavior about risk is highly affected by climate change psychological distance. Moreover, psychological distance five dimensions were on the basis of construal level theory geographic (Geo), psychological (Psy), uncertainty (Unc), temporal (Tem) and social (Soc) which were additionally categorized in to 16 indicators. These four tehsils study areas Bait communities descriptive statistics were evaluated and contrasted. To determine comparison in these communities' the test of chi-square was used. In scenario of psychological distance, three relevant questions (Psy1, Psy2, Psy3) were used for appropriate assessment whereas in the first aspect (Psy1) the respondents from Jampur tehsil were somewhat less liable about as climate change causing in charge for floods. In comparison, the estimated value of chi-square ($\chi^2 = 89.675$, $p = 0.000$) elaborated as in the comebacks about psychological magnitudes in the chosen communities of the study area were considerably different. The community of Sadiqabad tehsil rather than other communities having relatively higher responses (Psy2) as censure human activities major reason of floods. Estimates indicated as inhabitants were extremely uncertain regarding change in climate and its related effects whereas the value of chi-square ($\chi^2 = 38.743$, $p = 0.000$) illustrated the variations among communities regarding human factors to climate change. In the aspect

Table 3 Respondents socioeconomic feathers of both study areas with percentage and frequency

Respondents characteristics	Rahim Yar Khan district				Rajanpur district				Both districts (398)	
	Khanpur tehsil (101)		Sadiqabad tehsil (98)		Jampur tehsil (97)		Rajanpur tehsil (102)		All four tehsils	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Respondents age (in years)										
Less than 20	7	6.93	3	3.06	6	6.19	5	4.91	21	5.28
21–30	21	20.79	18	18.37	15	15.46	17	16.67	71	17.84
31–40	36	35.64	29	29.59	23	23.71	28	27.45	116	29.15
41–50	27	26.73	31	31.63	29	29.90	33	32.35	120	30.15
Above 50	10	9.90	17	17.35	24	24.74	19	18.63	70	17.59
Household head employment status										
Employed full time	71	70.30	62	63.26	59	60.82	58	56.86	250	62.81
Employed part time	4	3.96	3	3.06	2	2.06	5	4.91	14	3.52
Unemployed	23	22.77	29	29.60	34	35.05	32	31.37	118	29.65
Retired	3	2.97	4	4.08	2	2.06	7	6.86	16	4.02
Household head education status										
Illiterate	27	26.73	28	28.57	30	30.93	35	34.31	120	30.15
Schooling up to (5 years)	34	33.66	31	31.63	29	29.90	28	27.45	122	30.65
Schooling (8 years)	21	20.79	17	17.35	19	19.59	23	22.55	80	20.1
Schooling (10 years)	12	11.88	11	11.22	13	13.40	10	9.80	46	11.56
Schooling (14 years)	5	4.95	6	6.12	5	5.15	4	3.92	20	5.03

Table 3 (continued)

Respondents characteristics	Rahim Yar Khan district				Rajanpur district				Both districts (398)	
	Khanpur tehsil (101)		Sadiqabad tehsil (98)		Jampur tehsil (97)		Rajanpur tehsil (102)		All four tehsils	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Schooling above (14 years)	2	1.98	5	5.10	1	1.03	2	1.96	10	2.51
Livelihood main sources										
Livestock and agriculture	54	53.47	59	60.21	61	62.90	67	65.69	241	60.55
Services sector	12	11.90	11	11.25	10	10.31	13	12.75	46	11.56
Private sector	21	20.80	18	18.37	17	17.53	15	14.71	71	17.84
Industrial sectors	5	4.95	6	6.12	3	3.10	5	4.91	19	4.77
Miscellanies sources	9	8.91	4	4.08	6	6.19	2	1.96	21	5.28

Table 4 Respondents socioeconomic feathers of both study areas with percentage and frequency

Respondents characteristics	Rahim Yar Khan district				Rajanpur district				Both districts (398)	
	Khanpur tehsil (101)		Sadiqabad tehsil (98)		Jampur tehsil (97)		Rajanpur tehsil (102)		All four tehsils	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Income per month in PKRs[a]										
Up to 15,000	18	17.82	15	15.31	29	29.90	26	25.49	88	22.11
15,000–30,000	37	36.64	43	43.88	34	35.05	38	37.25	152	38.19
30,000–40,000	24	23.76	21	21.42	19	19.59	25	24.51	89	22.36
40,000–50,000	18	17.82	16	16.33	14	14.43	13	12.75	61	15.33
Above 50,000	4	3.96	3	3.06	1	1.03	0	0	8	2.01
Ownership of house										
Owned house	80	79.20	83	84.69	89	91.75	93	91.18	345	86.68
Owned with mortgage house	7	6.93	9	9.18	6	6.19	4	3.92	26	6.53
Privately renting	2	1.96	1	1.02	0	0	0	0	3	0.75
Social-based housing	10	9.90	6	6.12	5	5.15	3	2.94	24	6.03
Residency length in years										
Up to 10	7	6.93	5	5.10	3	3.09	4	3.92	19	4.77

Table 4 (continued)

Respondents characteristics	Rahim Yar Khan district				Rajanpur district				Both districts (398)	
	Khanpur tehsil (101)		Sadiqabad tehsil (98)		Jampur tehsil (97)		Rajanpur tehsil (102)		All four tehsils	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
10–20	24	23.76	27	27.55	21	21.65	22	21.57	94	23.61
20–30	36	35.64	32	32.65	35	36.08	33	32.35	136	34.17
30–40	19	18.81	16	16.32	14	14.29	18	17.65	67	16.84
Above 40	15	14.85	18	18.37	24	24.74	25	24.51	82	20.61

[a] 1$ = Rs 159.46 in November 2020

Table 5 Psychological distance to climate change indicators analysis with mean and standard deviation[a] values

Indicators	Rahim Yar Khan district		Rajanpur district			
	Khanpur tehsil	Sadiqabad tehsil	Jampur tehsil	Rajanpur tehsil	Chi-square test	Overall
Psychology						
Psy1	2.36 (0.94)	2.61 (1.13)	2.04 (1.06)	2.19 (0.74)	89.675 (0.00)	2.35 (0.93)
Psy2	2.47 (0.89)	2.74 (0.71)	2.39 (0.87)	2.81 (0.79)	38.743 (0.00)	2.65 (0.81)
Psy3	2.94 (0.77)	3.09 (0.68)	2.86 (0.70)	2.94 (0.71)	31.379 (0.00)	2.96 (0.69)
Geographic						
Geo1	2.68 (1.43)	2.21 (1.13)	2.59 (1.41)	2.17 (1.64)	91.647 (0.00)	2.41 (1.57)
Geo2	3.58 (0.88)	3.49 (0.68)	3.17 (0.72)	3.65 (0.78)	83.854 (0.00)	3.47 (0.76)
Geo3	2.69 (0.84)	3.71 (1.19)	3.37 (1.21)	2.49 (0.98)	89.764 (0.00)	3.06 (1.12)
Social						
Soc1	3.51 (0.81)	3.98 (0.91)	3.43 (1.21)	.3.29 (0.71)	79.863 (0.00)	3.55 (0.98)
Temporal						
Tem1	3.47 (0.81)	3.91 (0.78)	3.54 (0.73)	3.69 (0.68)	37.431 (0.00)	3.65 (0.79)
Tem2	3.12 (1.14)	3.34 (0.83)	3.10 (1.16)	2.81 (1.26)	176.439 (0.00)	3.09 (1.27)
Tem3	3.47 (0.97)	2.64 (1.38)	2.38 (1.29)	3.71 (0.81)	104.567 (0.00)	3.05 (1.18)
Tem4	1.89 (1.23)	2.26 (1.17)	1.74 (1.34)	1.81 (1.39)	79.693 (0.00)	1.93 (1.37)
Uncertainty						
Unc1	2.98 (0.78)	3.21 (0.68)	3.54 (0.63)	2.48 (0.83)	89.465 (0.00)	3.06 (0.57)
Unc2	3.68 (0.94)	2.34 (1.26)	2.73 (1.34)	3.57 (0.79)	143.693 (0.00)	3.09 (0.54)
Unc3	2.46 (0.88)	3.47 (0.77)	2.79 (1.02)	2.18 (0.64)	136.584 (0.00)	2.72 (0.78)
Unc4	2.89. 0.79)	3.27 (1.23)	3.81 (0.97)	3.29 (0.64)	98.386 (0.00)	3.31 (1.14)
Unc5	3.38 (1.12)	1.96 (0.84)	2.57 (1.49)	3.84 (0.69)	187.29 (0.00)	2.84 (1.34)

[a]Standard deviation indicated in parenthesis

of climate change quantification (Psy3), respondents were liable in the direction of middle value which illustrates that the issue stayed indistinct to the majority of the respondents. In the aspect of psychological dimension on the whole respondents from all rural flood prone communities stayed vague as illustrated in Table 5.

Geographic distance perceived as second aspect which was determined by applying the three main indicators (Geo1) climate change likely affected by local area, (Geo2) developing countries will mostly affected by climate change and (Geo3) far away areas from here will mostly affected from climate change. Both study districts Rajanpur and Rahim Yar Khan are irrigated, rain-fed, moreover severely and consecutively flood affected areas in the Punjab region of Pakistan (PDMA Punjab, 2020; PBS, 2021). Farming community from these regions well informed about climate dynamics and abnormal weather pattern (Ahmad and Afzal, 2022; Mahmood et al., 2020). Overall flood-prone rural communities' responses replicates as inhabitants of the area have the same opinion that climate change is distressing their area. In the aspect of the indicator Geo1, semantic different responses were illustrated as elaborated with the value of chi-square ($\chi^2=91.647$, $p=0.000$). In the overall scenario of these flood-prone communities, respondents from Rajanpur tehsil were more of a mind in the direction of differences that as developing countries severely affected from climate change whereas to some extent respondents from other communities were also having differences as indicated in Table 5. In the study area, the aspect of second indicator Geo2 responses was also statically diverse in the communities as indicated by the chi-square ($\chi^2 = 83.854$, $p = 0.000$). In the scenario of the question whether climate change distressing distant location, rural communities by and large responses concludes that inhabitants were unsure that change in climate would influence distant location. In the study area, among communities, responses regarding G3 were spatially dissimilar as illustrate in the chi-square ($\chi^2 = 89.764$, $p = 0.000$). Social dimension among the communities was determined by single indicator such as Soc1 (peoples likely higher impacted by climate change) while Jampur tehsil respondents remained differ and rest of the communities of the study area revealed and proclivity regarding this Soc1 question as illustrated in Table 5.

In this study, four major indicators Tem 1 (At the level Pakistan having the effect of climate change), Tem 2 (Peoples see climate change direct threat), Tem3 (Climate change effect have personally experienced by peoples) and Tem4 (People understanding climate change effects future generations) were used for assessment of temporal distance. In the study area, overall communities have the consensus as in Pakistan in the upcoming 25–50 years sever effects of climate change will more destructive regarding indicator of Tem1 as justified by the value of chi-square ($\chi^2 = 37.431$, $p = 0.000$). In the response of indicator Tem2, overall communities have strong perception as there is immediate effect of climate change while having the value of chi-square ($\chi^2 = 176.439$, $p = 0.000$). In the overall aspect of question Tem3, all communities having personally understanding and experience about effects of climate change regarding the significant value of the chi-square ($\chi^2 = 104.567$, $p = 0.000$). Overall communities in the research area having the consensus regarding Tem4 as climate change severe effects have to bear by upcoming generation in the future as having the value of chi-square ($\chi^2 = 79.693$, $p = 0.000$) while all communities temporal dimension regarding four indicators was statically different as justified by the chi-square value as illustrated in Table 5.

Climate change uncertainty was assessed in the study area by analyzing the five indicators whereas in the aspect of first uncertainty indicator Unc1, on the whole research communities understand that inhabitants are unsure that climate change is incident and having the value of chi-square ($\chi^2 = 89.465$, $p = 0.000$). In the second indicator Unc2, inhabitants almost all communities rather than Khanpur settled to several scope that gravity to change in climate is embroidered while having the statistical significant the value of chi-square ($\chi^2 = 143.693$, $p = 0.000$). Furthermore in the aspect of indicator Unc3, inhabitants of the study area were uncertain that for the most part scientist's culpability human participation for reasons of climate change with value of chi-square ($\chi^2 = 136.584$, $p = 0.000$). Scientists having uncertain aspect of climate change effects in future regarding the indicator Unc4 having value of chi-square ($\chi^2 = 98.386$, $p = 0.000$). In the aspect of indicator Unc5, responses conclude so as to overall rural inhabitants were unsure by the specified testimonial apart from Sadiqabad wherever inhabitants were tending in the direction of disagreement while having the value of chi-square ($\chi^2 = 187.29$, $p = 0.000$) as indicated in Table 5.

In relevant to climate change, psychological distance having five dimensions such as psychological, social, geographic, uncertainty and temporal were estimated by the using one way ANOVA test and descriptive statistics as indicated in Table 6. In the study area communities, overall responses were elaborated moderate psychological distance while estimated values of ANOVA ($F = 3.216$, $p = 0.011$) indicated the significant difference apparent in the communities. In the study area, estimated F-statistics low value illustrated as overall communities are more bunched jointly than surrounded by community unpredictability. Furthermore, the distance in the mean is undersized rather to a random error

Table 6 Psychological distance to climate change dimension-based analysis with mean and [a]standard deviation values

Dimensions	Khanpur tehsil	Sadiqabad tehsil	Jampur tehsil	Rajanpur tehsil	ANOVA values	Overall
Psychological	2.48 (0.63)	2.67 (0.49)	2.38 (0.41)	2.59 (0.47)	F = 3.216, p value = 0.011	2.53
Geographic	3.11 (0.69)	2.89 (0.54)	3.27 (0.58)	2.93 (0.71)	F = 3.974, p value(0.003)	3.05
Social	3.28 (0.74)	3.97 (0.87)	3.46 (1.29)	3.18 (0.84)	F = 7.962, p value = 0.001	3.4725
Temporal	2.98 (0.68)	3.17 (0.64)	2.81 (0.61)	2.94 (0.58)	F = 6.341, p value = 0.000	2.975
Uncertainty	3.19 (0.44)	2.74 (0.38)	3.06 (0.47)	2.87 (0.63)	F = 7.197, p value = 0.003	2.965
Overall	3.01 (0.39)	3.09 (0.27)	2.99 (0.34)	2.90 (0.31)	F = 4.654, p value = 0.000	2.998

[a]Standard deviation indicated in parenthesis

contained by each rural community. For this reason, it remained unfinished that all such rural inhabited communities are dissimilar at level of population. In the aspect of geographical distance, same responses were experienced while with higher value of ANOVA (F = 3.974, p = 0.003) that indicated the distinction in the communities was manifest. Social distance responses incidental so as to individuals from all rural communities mainly the Sadiqabad imitated as socially distant behavior. For the time being, inhabited respondents professed a number of shock related change in climate to be outlying away even as higher conformity was evaluated concerning uncertainty connected to effects of climate change. In the all dimensions, there was observed the higher value of ANOVA illustrating so as to reply for the other dimensions were statically dissimilar among all communities in the study area as indicated in the estimates of Table 6.

3.2 Flood risk perception indicator-based analysis

Awareness, worry and preparedness are three major components in which risk perception is generally classified whereas these components are further divided in to twenty four sub-components to access the flood risk perception of four flood-prone communities of two districts Rahim Yar Khan and Rajanpur. In post-flood recovery, coping capacity, mitigation actions, and precautionary measures are highly influenced by preparedness aspect which classified in to eleven indicators to investigate the preparedness of the study area. Flood-prone communities respondents were inquired about their preparation regarding flood preparedness as the estimates illustrated that they discussed this aspect with their family and professed themselves to be get ready to some level. In contrast to other communities' respondents of Rajanpur tehsil were highly concerned to looking for information of flood risk in upcoming era and also sure regarding their managing capability devoid of outer hold and likely a high possibility of receiving insurance as indicated in Table 7. Overall participation of respondents in the study communities were almost certain regarding future flood training programs participation, flood proofing their houses from upcoming floods and considerate the protocols of early warning system. Responses from the study area respondents make it clear as they have more trust on media updated reports rather than government authorities. In contrast to other communities, Rajanpur tehsil inhabitants were more conscious about their houses preparedness measures to future floods as indicated in Table 8.

Table 7 Flood risk perception indicator-based analysis with mean and standard deviation

Indicators	Khanpur tehsil	Sadiqabad tehsil	Jampur tehsil	Rajanpur tehsil	Chi-square test	Overall
Preparedness						
Pre1	2.98 (0.69)	3.34 (0.71)	3.29 (0.48)	3.21 (0.56)	78.432 (0.000)	3.205 (1.29)
Pre2	3.47 (0.58)	3.41 (0.53)	3.84 (0.44)	4.13 (0.49)	64.243 (0.000)	3.712 (0.68)
Pre3	3.84 (0.87)	2.91 (0.67)	4.23 (0.73)	3.97 (0.66)	74.651 (0.000)	3.741 (0.87)
Pre4	3.36 (1.14)	3.89 (0.97)	3.74 (0.89)	4.31 (1.27)	89.453 (0.000)	3.825 (1.43)
Pre5	3.79 (0.91)	2.96 (0.69)	3.81 (0.94)	4.56 (1.43)	184.826 (0.000)	3.78 (0.94)
Pre6	3.16 (0.78)	3.69 (0.81)	3.54 (0.69)	3.78 (0.97)	67.9543 (0.000)	3.543 (0.78)
Pre7	2.97 (1.28)	2.59 (1.46)	2.24 (1.13)	2.46 (0.91)	147.435 (0.000)	2.565 (1.24)
Pre8	3.04 (1.43)	3.87 (1.54)	3.69 (1.48)	2.27 (0.84)	129.287 (0.000)	3.2175 (0.74)
Pre9	2.38 (1.21)	2.54 (1.33)	2.17 (1.12)	1.38 (0.76)	73.243 (0.000)	2.1169 (1.18)
Pre10	2.93 (0.81)	3.97 (1.28)	3.74 (0.89)	2.91 (0.78)	93.216 (0.000)	3.3875 (0.96)
Pre11	3.56 (1.14)	3.19 (0.87)	3.81 (0.94)	4.58 (0.83)	87.967 (0.000)	3.785 (1.16)
Worry						
Wor1	3.97 (1.28)	2.83 (0.79)	3.76 (1.31)	4.68 (0.49)	157.674 (0.000)	3.81 (1.34)
Wor2	4.74 (0.68)	3.94 (0.87)	2.89 (0.73)	4.03 (0.97)	173.541 (0.000)	3.9 (0.87)
Wor3	3.67 (0.92)	3.11 (1.24)	3.46 (1.38)	3.97 (0.59)	132.921 (0.000)	3.55 (1.29)
Wor4	4.06 (0.87)	3.67 (1.31)	4.29 (0.77)	4.26 (0.48)	127.743 (0.000)	4.06 (0.76)
Wor5	3.98 (0.97)	2.88 (1.28)	3.78 (1.69)	4.19 (0.56)	1.68.297 (0.000)	3.71 (1.37)
Wor6	3.73 (1.24)	2.76 (1.14)	2.89 (1.82)	4.52 (0.68)	187.432 (0.000)	3.47 (1.49)
Wor7	3.96 (1.16)	2.97 (0.68)	3.41 (0.87)	3.69 (0.93)	74.863 (0.000)	3.51 (0.76)
Wor8	3.82 (1.21)	3.69 (1.12)	4.16 (1.26)	4.71 (0.71)	106.473 (0.000)	4.095 (1.03)
Experience and awareness						
E&A1	3.87 (1.34)	3.61 (1.19)	3.47 (1.38)	4.86 (1.26)	138.241 (0.000)	3.95 (1.43)
E&A2	2.37 (1.28)	2.54 (1.12)	2.04 (1.21)	2.13 (1.41)	64.892 (0.000)	2.27 (1.31)
E&A3	4.11 (0.96)	3.48 (0.76)	3.16 (0.87)	3.64 (0.74)	81.532 (0.000)	3.55 (1.23)
E&A4	2.81 (1.16)	3.83 (1.31)	3.24 (1.49)	1.98 (1.14)	128.841 (0.000)	2.97 (1.39)
E&A5	3.98 (0.94)	2.75 (1.28)	2.97 (1.44)	4.16 (0.88)	136.254 (0.000)	3.46 (1.28)

In worry and flood mitigation measure, positive association was illustrated in literature (Terpstra, 2011; Zaalberg et al., 2009). In this research work, worry dimension was classified in to eight indicators to investigate in what way inhabitants of particular rural flood-prone inhabitants are worried regarding the flood condition in relevant area. In overall communities except Sadiqabad, inhabitants of the areas were extremely terrified of flood risk whereas the respondents of Sadiqabad were less anxious. Floods also cause the severe losses of lives in the whole communities and having higher social environmental damages rather than floods disasters as indicated in Table 7. In overall study area, Jampur tehsil respondents were highly conscious about the issue of food security and destruction of houses due to floods whereas the overall aspect illustrated the higher disturbance of their lifestyle negatively influencing the access of utility services.

Flood risk perception of inhabited population is highly influenced by their level of knowledge and awareness as such component is further categorized in to five types as E&A1 to E&A5 as highlighted in Table 7. In the overall communities, inhabited of the

Table 8 Dimension-based flood risk perception analysis

Indicators	Khanpur tehsil	Sadiqabad tehsil	Jampur tehsil	Rajanpur tehsil	Chi-square test	Overall
Preparedness	3.76 (0.49)	3.58 (0.43)	3.83 (0.51)	3.29 (0.38)	34.641 (0.000)	3.615
Worry	4.38 (0.73)	3.29 (0.87)	3.91 (0.64)	4.27 (0.41)	91.812 (0.000)	3.9625
Experience and awareness	3.87 (0.97)	3.46 (0.31)	2.79 (0.89)	3.41 (0.39)	28.487 (0.000)	3.3825
Overall flood risk perception	4.01 (0.71)	3.44 (0.39)	3.51 (0.28)	3.65 (0.34)	64.987 (0.000)	3.653

study area were well informed about their area evacuation routes and while having limited knowledge regarding the protocol of emergency. Inhabitants of Khanpur tehsil in contrast to on the whole communities having higher awareness of warning and forecasting of floods whereas the pattern of unusual weather knowledge was higher among the residents of Sadiqabad tehsil. In general, inhabitants of the study area not confident about the possibility of flood incidence in these flood-prone rural areas whereas the respondents of Sadiqabad tehsil were highly apt regarding the improbability of floods incidence in these areas as illustrated in results of Table 7. Major components of risk perception awareness, worry and preparedness were highlighted with descriptive statistics and estimated with ANOVA test. Risk perception component of worry estimated value of ANOVA having significant related to all dimensions illustrating the statistical significant outcomes.

3.3 Affects of socioeconomic factors on flood risk perception and psychological distance related to climate change

Estimates regarding psychological distance related to climate change are indicated in Table 9 illustrating the goodness of fit model with higher F-value (62.34, *p* value 0.000). Moreover, estimates also highlighted the higher negative influence (− 8.73) in the psychological distance and homeownership indicating as inhabited of the area having their own houses in the area more suffer to psychological distance to climate change. In aspect of estimated results, there is strong negative influence (− 7.89) regarding the number of flood experience elaborating as inhabitants having the severe experience of flood destruction more worried about forthcoming frequent floods rather than climate change. Estimates illustrated as inhabitants with increasing age (3.97) having higher psychological distance to climate change. Furthermore, inhabitants having lower income status and mostly facing issues regarding expenditure in their routine living less conscious about psychological distant to climate change.

In model 2, higher value of F (62.37, p value = 0.000) illustrated the good fit of regression model about flood risk perception. Estimates in Table 9 indicated as increasing age declines (− 3.94) the flood risk perception illustrating as young respondents in the flood-prone area having higher flood risk perception rather than other aged groups. In flood risk perception and homeownership, estimates illustrated the higher significant and positive (8.74) relationship as highlighting the higher perception of risk among owners rather than others inhabitants in the flood-prone area. In the income aspect among inhabitants of flood-prone area, higher anxiety regarding flood risk perception was estimated among the higher income groups (3.94) rather than poor and medium income groups. In model 2, results illustrated the significant and positive association in higher perceived flood risk perception and their flood experience (7.88) illustrating as inhabitants with more experience of floods having higher anxiety regarding about perception on flood risk rather than less experienced and newly inhabited flood-prone community.

3.4 Liaison regarding perception of flood risk and psychological distance related to climate change

Estimates in Table 10 illustrated as inhabitants of flood-prone area with limited knowledge and awareness about flood risk destruction consider floods no harm their livelihood in their routine life. Furthermore, within the flood-prone area, those inhabitants who consider climate change a global issue and severely affecting their areas consider climate change sever to their areas and livelihood. For that reason, as inhabitants having no anxiety regarding climate change as phenomenon of geographically distant, more possible to having higher perception conscious to the curious to the weather prototype and urgent situation procedure necessary higher information to pre and post floods. Estimates of the study indicated the moderate relationship in worry and social distance illustrating as inhabited having the less significance to flood disasters whereas consider higher perception and worry about the affects of climate change. In the aspect about association to awareness and temporal distance (− 0.284) negative and restrained results were estimated. Inhabitants of the study area, consider climate change ongoing or imminent threat having higher familiarity and awareness in their flood-prone areas. Correlation estimates in Table 10 illustrated the negative relation in worry and uncertainty (− 0.387) as inhabitants of flood-prone area relatively lower perception about climate change having no worry to upcoming floods and its destructions. In aspect of preparedness, inhabitants those consider themselves well prepared of upcoming floods have overconfidence while not aware about actual scenario of climate change and future confronting threats.

4 Discussion

Climate change has raised global destruction due to consecutive occurrence of natural disasters particular the floods in South Asian region. Pakistan due to consecutive floods occurrence faced major losses of lives and economic resources. This research work focused to investigate psychological distance and flood risk perception relating to climate change in flood-prone Bait areas of Punjab. Major population engaged in farming practices and having marginal income pattern for their livelihood. Awareness, worry and preparedness to flood were three major indicators to quantify perception of flood risk whereas uncertainty, temporal, social, geographical and psychological as five dimensions applied to measure psychological distance. In psychological assessment majority respondents of study area consider human activities and climate change responsible for consecutive floods while quantification of climate change aspect remained unclear in majority respondents. The reason is that human encroachment in riverine areas and increasing temperature due deforestation and rising mechanization usage caused rising disasters as these findings are alike with the studies of Szeto et al. (2015), Shao and Goidel (2016), Munoz-Carrier et al. (2020). In geographical distance, majority inhabited remained sure as climate change distressing their local area and severely influencing developing countries while not in consensus as climate change negatively affects far areas. In social distance, majority responded are in consensus

Table 9 Regression of socioeconomic variables related to psychological distance and flood risk perception to climate change

Study independent variables	Model 1		Model 2	
	Psychological distance to climate change		Flood risk perception to climate change	
	OLS estimates	Significance level	OLS estimates	Significance level
Respondents age	3.97 (0.001)	0.000	− 3.94(0.001)	0.000
Ownership of house	− 8.73 (0.024)	0.000	8.74(0.024)	0.000
Income per month	− 3.91 (0.003)	0.000	3.94(0.003)	0.000
Numbers of floods experienced	− 7.89 (0.011)	0.000	7.88(0.011)	0.000
Adjusted R^2	0.413		0.416	
F-value	62.34 (p value = 0.000)		62.37 (p value = 0.000)	

Standard error are shown in parenthesis

as climate change severely influenced on social basis. Particular perspective regarding such aspect is that rural far areas remain out of industrialization and urban pollution and wastage so relatively remains less affected of climate change rather than urban and rural urban neighboring. These social and geographical distance findings are similar with the studies of Capstick et al. (2015) and Hahnel and Brosch (2016). In the temporal dimension, all communities in the study area having the consensus as climate affected their livelihood and overall country while having future anticipation of threat to next generations because of having to facing and experiencing consecutive floods and destruction in current couple of decades. These findings are in line with the studies of Schafer and Neil (2017) and Pickering et al. (2020). Uncertain aspect regarding climatic dynamics, its severity and human participation remains in the majority community in the study area because of the most frequent disasters happening such as erratic rains, floods caused raised livelihood vulnerability in the limited era. These findings are alike with the studies of Smith and McAlpine (2014), Shao and Goidel (2016) and Rutjens et al. (2018).

Awareness, worry and preparedness were highlighted major components of risk perception. In the study area, rural communities of Jampur and Rajanpur have higher preparedness about flood disasters rather than Sadiqabad and Khanpur rural inhabitants. Furthermore, communities located and having more neighboring area of Indus river such as Jampur, Rajanpur and Sadiqabad are more worried about future flood disasters. In the overall communities, majority of the inhabitants are aware about the situation of flood in these flood-prone areas. Estimates of the study indicated as communities located near Chenab river having lower perception of flood rather than those communities located near Indus river. In study area, preparedness is highly influenced by post-flood recovery, coping capacity, mitigation actions, and precautionary measures as these findings are in line with the studies of Ahmad et al. (2019) and Khan et al. (2021). Terrified flood risk, limited access of services and reduced mitigation measures are major causes of worry of study area respondents which can managed with appropriate access of hazards services with training and information as such results are consistent with the studies of Rana and Routray (2016), Rana et al. (2020). In aspect of knowledge and awareness level regarding overall communities, inhabited of the study area were well informed about their area evacuation routes and

Table 10 Correlation in psychological distance dimensions to climate change and flood risks perception

	Psychological	Geographic	Social	Temporal	Uncertainty	Preparedness	Worry	Awareness
Psychological	–	– 0.074	– 0.296*	0.318**	– 0.069	0.087	– 0.061	0.183**
Geographic	– 0.074	–	0.199**	0.246**	0.231**	0.113*	0.049	– 0.399**
Social	– 0.296*	0.199**	–	– 0.154**	– 0.026	– 0.041	0.298**	– 0.161**
Temporal	0.318**	0.246**	– 0.154**	–	0.194**	0.079	– 0.093	– 0.284**
Uncertainty	– 0.069	0.231**	– 0.026	0.194**	–	– 0.018	– 0.387**	– 0.301**
Preparedness	0.087	0.113*	– 0.041	0.079	– 0.018	–	0.171**	– 0.299**
Worry	– 0.061	0.049	0.298**	– 0.093	– 0.387**	0.171**	–	– 0.187**
Awareness	0.183**	– 0.399**	– 0.161**	– 0.284**	– 0.301**	– 0.299**	– 0.187**	–

**Significance correlation level at 10 percent, *significance correlation level at 5 percent while having limited knowledge regarding the protocol of emergency. Findings of floods incidence apparent possibility and emergency protocols are in line with the studies of Rana et al. (2020) and Khan et al. (2021) whereas higher varying perception about future floods occurrence was estimated in study communities as estimates are alike with the study of Qasim et al. (2015).

In perspective of socioeconomic factors, psychological distance and risk perception about climate change inhabited of the area having their own houses and having the severe experience of flood destruction were more conscious while lower income inhabitants less conscious about psychological distant to climate change. The reason is that experienced farmers having faced destruction of flood disaster while low income inhabitants having limited assets so having limited worry and less conscious of climate change disasters as findings are in line with the studies of Qasim et al. (2015), Wang et al. (2018), Ullah et al. (2020) and Rana et al. (2020). Young in contrast to aged and household owner rather than others inhabitants having higher risk perception of psychological distant and climate change. More particular factors are as young inhabitants more updated to technical advancements so more updated about climate change information in the same way household owner aware about destruction of their houses so more conscious about risk as these findings are similar with the studies of Qasim et al. (2015), Ullah et al. (2020) and Ahmad and Afzal (2022). In the liaison of flood risk perception and psychological distance related to climate change indicated as inhabitant's having well aware about climate change global perspective, sure related to its ongoing imminent threats and anticipated destruction in flood-prone areas more conscious about implementing the floods preparedness measures as these findings are similar with the studies of the Shao and Goidel (2016), Wang et al. (2018) and Khan et al. (2021).

5 Conclusion and suggestions

Flood-prone communities are facing severe destruction due to climate change consecutive flooding which can be minimized by adapting multiple flood risk and climate change measures in which psychological distance and perception of flood risk related to climate play significant role. Adaptation to climate change and disaster risk reduction philosophies can help to integrate and bridge through these concepts. Estimates of the study make available an absorbing imminent in to perception of flood risk and psychological distance related to climate change. Findings illustrated as social distance was reasonably higher as compared to other aspect of psychological distance to climate change. In aspect of flood risk perception, inhabitants were pragmatic to be more scared than awareness and preparedness. Flood-prone communities inhabited near Indus river rather than Chenab river having higher risk perception because more frequent and higher destructive floods occurred in Indus rive so inhabitants living near Indus river having higher perception of flood in this area. Worry and uncertainty having the negative correlation according to findings of the study illustrating as inhabitants were more worried those were dubious to climate change. "Fear of Unknown" theory supported such finding of negative correlation where unknown phenomena having more fear in the population.

In general public, it is mandatory to reducing psychological distance and develops to raise their flood risk perception for appropriate application of preventive measures. More particularly, the disaster planning institutes and disaster management authorities can beneficial from these findings. Some significant policy measure need to implement firstly flood management authorizes need of launching campaigns of climate change awareness and amalgamate flood plans of flood risk management in flood-prone areas. Secondly, it is mandatory to improve the strategies of risk communication to decrease psychological distance and capable inhabited population to comprehend climate change enhanced also guide to more sustainable manners. Lastly, more particularly need to formulate off-farm employment opportunities schemes to promote in such disaster-prone areas to reducing the livelihood vulnerability and develop social status of inhabited population. This research work having some limitations and need to future research guidelines. Firstly, this study limited to just two districts so need to expand the area and more in-depth studies to urban and rural areas for more significant policy outcomes. Lastly, in the reason of religious and cultural constraints, limited female participated in survey as compared to men so need enlarge motivational perspective for increasing women participation for more suitable outcomes of the study. In contrast to such limitations, this study has its significance regarding its findings in addressing to climate change issue and feasible measures to capturing such risks.

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Declarations

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