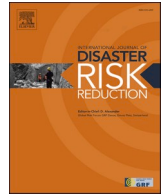




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COVID-19 risk perception and coping mechanisms: Does gender make a difference?

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ABSTRACT

The novel coronavirus disease (COVID-19) emerged as a real threat to humans, drastically disrupting everyday life in 2020–21. Although the pandemic affected people from all walks of life, irrespective of age or gender, the way the risk is perceived varies from one person to another. The pandemic risk reduction strategies can only be effective if individuals and communities respond positively to them, and for that, it is important to understand how the risk is perceived and responded to, differently by different groups of people. Gender plays a vital role in shaping risk perceptions and coping strategies, reflecting the predisposition of the public to accept health interventions and take precautionary measures. This study aims to understand the gender differences in COVID-19 risk perception and coping mechanisms – Pakistan is selected as a case study area. Following on from designing the questionnaire, which included 40 indicators grouped into domains (four risk perception and three coping mechanisms domains), an online survey was conducted, and a sample of 389 respondents was collected (248 male and 141 female). An index-based approach was used to quantify risk perception and its domains (fear, behaviour, awareness, and trust), and likewise coping mechanisms and their domains (problem, emotion, and action). Statistical tests were employed to ascertain the differences among both genders, whereas regression modelling was used to measure the effect of gender on overall risk perception and coping mechanisms. Results reveal that perceived fear and trust varied significantly between Pakistani men and women, while coping mechanisms were also notably different between the two genders. Females were found to perceive risks higher, complied more with the government's guidelines, and coped better than males in response to COVID-19. These findings imply that the gender aspect must be incorporated in designing effective communication and risk reduction strategies to efficiently address the current and potential future pandemic situations.

1. Introduction

The COVID-19 is a novel coronavirus reported first time in December 2019. Although, the research to understand the different attributes of COVID-19 is going at an unprecedented speed [1]. Still, not enough is known about its origin, causative factors, aetiology, morbidity rate, mortality rate, and its recurrence, etc. [2]. COVID-19 has emerged not

only as a public health issue but also as a geopolitical and socioeconomic concern [3]. Governments, oppositions, and organizations are using the COVID-19 associated aspects, especially mortality and morbidity rates, to safeguard their public and political images [4]. However, it is agreed that proper precautionary measures and preparedness can reduce exposure, contraction of infection, and ultimately, the pandemic risk. One common aspect about COVID-19 is that the hospitalization rate of

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males is higher than females. This implies that gendered behaviour, attitudes, and perceptions carry implications for pandemic risk communication and reduction strategies.

The role of gender is therefore extremely important in understanding the disaster risk, and ask for evaluating underlying gender-related factors and actions to be implemented. Research into gender risk perceptions can contribute to an additional understanding of gender-based interactions and influences [5]. Moreover, higher awareness of the risk can result in the adoption of better coping measures or actions [6]. Societies and organizations make a significant contribution to gender disparities, and thus, there is also an effect on variability in risk perceptions [5]. It has been observed that undertaking of preventive and containment measures differs by gender [7]. Regular lockdowns, isolation, mental stresses, and deteriorating economic conditions have made it essential for households to develop coping mechanisms in this period of global crisis. Therefore, it has become imperative to understand the risk perceptions and coping mechanisms of both genders.

Pakistan is surrounded by three of the worst affected countries by COVID-19, China (the epicentre of COVID-19), India (one of the worst COVID-19 hit countries in Asia) and Iran. Pakistan faces substantial gender disparities at social, economic, political and other levels [8]. According to The Global Gender Gap Report (2018), it is ranked one of the lowest (146th out of 149) countries in female economic participation, 145th in women's health and survival, and 97th in the domain of political empowerment [9]. Locally, the Pakistan Demographic and Health Surveys (PDHS) (2012–2013) reports that 12% of Pakistani adult women are deprived in child marriages, education, healthcare, and employment [10]. Pakistan is still not showing any encouraging progress to bridge the prevailing gender-based gap. It is feared that the current COVID-19 pandemic will further compound the already existing gender inequalities.

Though COVID-19 has been discussed with a clinical perspective and much has been published in the academic and research literature, the scientific community also calls for a more gender-based intersectional approach to cope with COVID-19 [7,11]. Generally, gendered dynamics are not considered in a pandemic which can potentially limit risk communication efforts [12]. Little is known about how the COVID-19 is linked to gender issues and how it influences risk perceptions and coping mechanisms regarding pandemics. In this regard, it is of paramount importance to conduct studies to measure the gender differences in COVID-19 risk perceptions and understand the differences in gendered coping mechanisms. The key objectives of this research are to examine if: (1) the COVID-19 risk perception varies among the male and female population; and (2) gender makes any difference to the mechanisms adopted to cope with COVID-19.

2. Gender and pandemics

Pandemics and epidemics are not something new to humanity and several devastating occurrences been recorded in the past [13]. Since the beginning of the 21st century, more than six major epidemics and pandemics have struck human life in different parts of the world, including, but not limited to, Ebola virus epidemic, Zika virus epidemic, Dengue virus epidemic, H1N1 virus epidemics, Middle East Respiratory Syndrome (MERS) epidemics, and the current pandemic of COVID-19 [14]. Generally, major pandemics in the past were caused by influenza viruses. Amongst all the recorded pandemics, the most iconic pandemic was the 'Spanish flu' that struck the world in 1918 and resulted in an estimated 17–100 million deaths [15–17]. The current COVID-19 pandemic is considered the worst in recent history, which has impacted more than 186 countries and shut down almost every business, both in the developed and developing countries [18]. In the wake of the most recent pandemic, it is aggressively advocated to wash hands regularly, wear masks and maintain social distancing by the governments and the World Health Organization to reduce the chances of virus transmission [19].

Gender provides an intersectional view of structural inequalities, social, economic, and cultural implications, and ultimately determinant of public health intervention. It fundamentally shapes risks and experiences [11,20]. Evidence from the COVID-19 outbreaks suggests that women could have a more detrimental effect than men in the long term [21]. Depending on the context and unique features of different groups, the gender differences are influenced differently. Furthermore, these differences may involve differing roles in crisis management, especially in the first phase of prevention and mitigation, and monitoring. For instance, in households and communities, women have an active role to play, which places them at the center of risk communication and reduction. Thus, gender influence must be ascertained to effectively tackle the current COVID-19 crisis and potential future pandemic situation.

Recent statistics from China, Spain, and Italy concerning the COVID-19 epidemic show that the proportion of men who die from the disease is significantly higher than that of women. For example, a study from China found that the fatality rate of men with the virus was approximately 65% higher than that of women [21]. Although there are uncertain explanations for this pattern as the earlier work suggests that cardiovascular disease rate (i.e., high blood pressure), and unhealthy or unsafe habits (i.e., smoking) among men is higher than women [22], -immune response is also different in the two genders [21]. Males also tend to suffer from the SARS disease more seriously than women, which may partially explain disparities in gendered use of tobacco [23]. Gender variations can also play a role in physical activity, dietary habits, smoke, dust exposure at work, etc., and related co-morbidities.

Both women and men tend to be vulnerable to pandemics depending on various sectors and professions. The role of men in the transportation of sick persons and other coordinated group response structures poses a risk of infection. For instance, during the 2013–16 Ebola epidemic in West Africa, men's motorcycle taxis faced a high risk of contamination, frequently leading to new transmission chains in previously unexposed villages [24]. However, the main caregivers for the ill are mostly women, who are also then vulnerable to infection [25,26]. Women and girls were expected to care for sick families during the Ebola outbreak in Western Africa in 2013–16, while cultural behaviour after death placed them at a greater risk where refusing to attend sick was perceived as a serious moral deficiency [27,28]. The epidemic in Western Africa has shown that females are more vulnerable to infection because of their status as caregivers and in funeral ceremonies [21]. Evaluation of the current COVID-19 economic impacts is also indicating inherent gendered variations [7,11]. These case studies concur that gender plays a vital role in pandemic risk reduction. Therefore, exploring the gender influence on risk perception and coping mechanisms has become essential.

2.1. Risk perception

The concept of risk perception is used to examine why people are taking (or not taking) precautions against external threats [29]. Risk perception should be understood to effectively communicate risk, and subsequently develop enhanced disaster risk mitigation strategies [30]. It is necessary to recognize the degree of vulnerability and risk to implement risk management strategies. Risk perception is used to determine a person's propensity to take preparatory and precautionary measures [31]. Therefore, risk perception and its appropriate quantification are important to devise successful coping strategies. However, if many unexpected attributes are involved, it becomes difficult to accurately calculate the risk perception [32]. Nevertheless, to some degree, the perception of risk is observable by taking attributes such as attitude, sensitivity, and fear into account [33]. Therefore, this study conceptualizes risk perception based on four domains, namely fear, behaviour, attitude, and trust (see Khan, Rana, and Nawaz 2020).

2.2. Coping mechanism

The year 2020 is an unprecedented year of transition and this change has been traumatic for many as people’s jobs, social lives, and well-being are adversely affected [35]. Governments have asked citizens to follow proper precautionary measures [36]. In the aftermath of dramatic change in daily life, trauma, and loss, many doubt their sense of purpose. The theory of coping can help us better understand the behaviours and responses [35,37]. The coping theory implies that there are four phases we encounter when facing a crisis: (1) evaluating the situation and our ability to cope with it, (2) use of problem-solving skills, (3) use of stress management approaches, and (4) then if the issue is persistent and important, seeking sense and reason despite the circumstances. To deal with this, it is important to carefully analyse the situation, and consider our capabilities. Clear assessments of the threat from COVID-19 are challenging because the information is constantly evolving, and global communication has led to the creation of misinformation.

To help survive, individuals, communities, and organizations need to react rapidly to emerging threats [35]. The capacity to cope is not an inherent irrational trait, but can dissolve the following trauma. This must be nurtured by self-care and safe environment as some people (including women and children) are extremely vulnerable to external threats. Such individuals need help learning how to cope and effectively adopt coping mechanisms to sustain themselves [21]. We need to develop problem-based coping strategies for local inhabitants and refine realistic mechanisms to tackle the threat posed by the COVID-19 epidemic. To maximize resistance to viral threats, we must provide self-care coping strategies and chronic disease management. It is even more important to remember and practice the basics such as social distancing to prevent the spread of the disease [19,38–42]. Some would use emotion-orientated coping strategies in times of great stress that normally involve evasion [43]. During a pandemic, coping strategies can lessen the effects and strengthen resilience, but they will not fully eliminate the risk. It is important to model the coping strategies of individuals to design appropriate responses [35]. This study, therefore, explores coping through the lens of problem-solving, emotional, and action-oriented mechanisms (see Gerhold 2020).

3. Methods

The focus of this study is to understand if males and females perceive COVID-19 risk and adopt methods to cope with this pandemic differently. This involved collecting primary data through a questionnaire survey, and then applying various statistical analyses methods to the collected data. Pakistan was selected as the case study area. The methodology mainly comprised: (1) questionnaire design and data collection; and (2) data analysis.

3.1. Questionnaire design and data collection

A comprehensive questionnaire was designed which captured the socioeconomic profile (age, education, household size, marital status, type of family, average income) of the respondents, their COVID-19 related risk perception, and the behavioural approaches they adopted to cope with the adverse impacts of this pandemic. The questions were grouped into various domains and indicators to assess the risk perception. The data were collected in four domains; (1) dread, fear, and worry (8 indicators); (2) behaviour and attitude (3 indicators); (3) awareness and knowledge (3 indicators); and (4) trust and confidence (7 indicators) (Table 1), whereas the behavioural attitude to cope with COVID-19 pandemic was assessed in terms of three different mechanisms (domains) namely problem-oriented (6 indicators), emotion-oriented (7 indicators), and action-oriented (6 indicators) (Table 2).

As conducting a physical (face-to-face) survey was not possible due to the pandemic, a digital questionnaire was developed (using Google Forms), - the survey was conducted online where data was collected

Table 1

COVID-19 related risk perception assessment domains and indicators.

Sr. No.	Domain, indicator, and question asked
Dread, Fear, and Worry	
F-1	<i>Perceived extent of fear to your life</i> How much are you afraid of your life from a COVID-19 infection?
F-2	<i>Perceived likelihood of getting infected</i> How likely do you think to get a COVID-19 infection?
F-3	<i>Increased occurrence of infections</i> How much are you afraid that COVID-19 will persist/spread in the future?
F-4	<i>Disruption of daily lifestyle</i> How much are you worried that this pandemic would disturb your daily lifestyle?
F-5	<i>Perceived danger to your family</i> How much are you worried that this pandemic is a danger for your family?
F-6	<i>Perceived danger to your community</i> How much do you think this pandemic is a danger for your community?
F-7	<i>Fear on the basis of current knowledge</i> How much afraid are you about this pandemic based on current knowledge?
F-8	<i>Fear on daily needs/supplies interruption</i> What are the chances of supply interruption during this pandemic?
Behaviour and Attitude	
B-1	<i>Perceived incapacity to deal</i> How much do you think can deal with the consequences of this pandemic? *
B-2	<i>Perceived adaptability of lifestyle</i> How much can you adapt lifestyles because of this pandemic?
B-3	<i>Change in relationships</i> How much do you think this pandemic can change your relationship with your neighbours and relatives?
Awareness and Knowledge	
A-1	<i>Perceived extent of familiarity</i> How much are you familiar with precautionary measures against this pandemic?
A-2	<i>Perceived community unprotection</i> How much is your community is protected from this pandemic? *
A-3	<i>Awareness about unknown risks</i> How much you agree that COVID-19 is something completely new for all of us?
Trust and Confidence	
T-1	<i>Trust on information acquired from official sources</i> How much do you trust the information provided by the government about this pandemic?
T-2	<i>Non-reliance on information acquired from different non-official sources</i> How much do you rely on/trust in the information about pandemic obtained from different sources? *
T-3	<i>Trust in disaster management and public health agencies</i> How much do you trust in disaster management agencies in dealing with this pandemic?
T-4	<i>Trust in disaster management policies and strategies</i> How much do you trust in emergency management policies in dealing with this pandemic?
T-5	<i>Trust in the information given by the local government</i> How much do you trust the information provided by your government about this pandemic?
T-6	<i>Trust in response by the provincial or federal government</i> How much do you trust the response provided by your government?
T-7	<i>Trust in science and experts</i> How much do you trust that science and experts will develop the vaccine within one year?

Note: Scale (1-very low to 5-very high); * Reversed in analysis.

through voluntary response techniques. The survey remained live between 7 and March 16, 2020, and a total of 379 individual responses (238 male and 141 female) were collected from all over Pakistan (majorly urban areas where internet access is higher compared to the rural areas).

3.2. Data analysis

Before proceeding with the analyses, the data was split into male (n = 238) and female (n = 141) responses. The socioeconomic characteristics of the respondents were assessed through frequency analysis, and the Chi-square test was applied to each category (age, education, household size, marital status, type of family, average income) to see if there was any difference between the male and female groups. Three

Table 2
Domains and indicators/questions for assessing COVID-19 related coping mechanism.

Domain and indicator/question asked	
Problem-oriented	
P-1	<i>I feel safe in my own home</i>
P-2	<i>I listen to the experts and follow their advice</i>
P-3	<i>I actively seek out new information about the current situation.</i>
P-4	<i>I am doing something completely new that I would never have done in other circumstances</i>
P-5	<i>I talk to someone who knows about it</i>
P-6	<i>I am seeking financial support from the government</i>
Emotion-oriented	
E-1	<i>I turn to my work or other activities to distract myself</i>
E-2	<i>I actively seek meditation to calm myself</i>
E-3	<i>It will emerge over time; there is nothing more to do but wait</i>
E-4	<i>I hope for a miracle</i>
E-5	<i>I try to make myself feel better by eating, smoking, or taking medication</i>
E-6	<i>I refrain from things that can trigger bad moods</i>
E-7	<i>I refuse to believe what is happening</i>
Action-oriented	
BE-1	<i>I wash my hands more than usual</i>
BE-2	<i>I avoid going out unnecessarily</i>
BE-3	<i>I avoid public spaces and transport</i>
BE-4	<i>I have bought disinfectants (soap, sanitizers, etc.) more than usual</i>
BE-5	<i>I have bought staple foods (flour rice, lentils, meat, etc.) more than usual</i>
BE-6	<i>I have bought protective equipment (masks, gloves, etc.) more than usual</i>

Note: Scale: (1-strongly disagree to 5-strongly agree).

separate analyses were used to identify gender differences and their impacts on risk perception and coping mechanisms.

The COVID-19 risk perception was analysed using the data of each indicator (total 21 indicators) through descriptive statistics such as mean and standard deviation (SD) – the statistical difference between the male and female groups was determined through the Chi-square test (χ^2). The index was constructed using the average weighting method (Eq. (1)), and overall risk perception was calculated by taking overall of all four domains (dread, fear, and worry; behaviour and attitude; awareness and knowledge; and trust and confidence) (Eq. (2)). The difference between male and female respondents in each of the four domains of risk perception was determined statistically by applying a *t*-test (domain data obtained by aggregating the corresponding indicators, see Table 1 showing domains and indicators used to assess COVID-19 risk perception). The four risk perception domains were then combined, and a *t*-test was applied to see if the overall COVID-19 risk perception was more in males or females.

$$CI = (W_1 + W_2 + W_3 + \dots W_n) / n$$

$$= \sum_{i=1}^n W_i / n \tag{1}$$

$$\text{Overall risk perception} = \frac{\text{Fear} + \text{Behavior} + \text{Awareness} + \text{Trust}}{4} \tag{2}$$

The same approach was applied to examine if gender made any difference to the mechanisms adopted to cope with COVID-19. Data of each indicator that assessed the coping mechanisms adopted by the respondents (total 19 indicators) was analysed through descriptive statistics such as mean and standard deviation (SD), whereas the statistical difference between male and female groups was assessed through the Chi-square test (χ^2 and *p*-value). The index was constructed using the average weighting method (Eq. (1)), and overall risk perception was calculated by taking the overall of all three domains (problem-oriented, emotion-oriented, and action-oriented) (Eq. (3)). The statistical variation between the male and female groups in each of the three domains of

coping methods was assessed through a *t*-test (domain data obtained by aggregating the corresponding indicators, see Table 2 showing domains and indicators used to assess COVID-19 coping mechanisms). The data of the three coping mechanism domains were aggregated, and a *t*-test was applied to have an overall idea of which of the two groups (male or female) adopted more coping strategies against COVID-19.

$$\text{Overall coping mechanism} = \frac{\text{Problem} + \text{Emotion} + \text{Action}}{3} \tag{3}$$

Lastly, a linear regression model was developed to see if gender difference made any impact on COVID-19 risk perception or the coping mechanisms adopted by the respondents during this pandemic. Multiple linear regression is a standard estimation technique in which an outcome is predicted by a linear combination of two or more predictor variables [45]. Based on the data obtained and the purpose of the study, the linear regression model was the best option to apply and understand the relationship between data variables. Two models were developed; – one for risk perception and the other for the coping mechanism (as dependent variable), and gender as an independent variable (Eq. (4)).

$$y_i = \beta_0 + \beta_1 x_1 + \epsilon \tag{4}$$

where.

- y_i = dependent variable
- x_1 = explanatory variable
- β_0 = *y*-intercept (constant term)
- β_1 = slope coefficients for the explanatory variable
- ϵ = the model's error term (also known as the residuals)

4. Results and discussion

4.1. Socioeconomic profile of respondents

The socioeconomic profile of male and female respondents provided some interesting insights (Table 3). Some characteristics were found to be similar, while others illustrated significant differences. In terms of age, 61% of male respondents were in the age group of 19–28 years old, while 69% of females fall in this age group. Around 16% of male respondents were older than 38 years, while this figure was only 8% of female respondents. The proportion of young male and female respondents was 2.5% and 7.1%, respectively. Overall, the age difference between male and female respondents was significant ($\chi^2 = 10.449$, *p*-value = 0.015). In terms of educational qualification, both male and female respondents had almost similar qualifications where 98% male and 97% female were found to be university graduates. The majority of respondents (both male and female) were single, and only 33% of male and 26% of female respondents were married.

Considering the household size of respondents, a noticeable proportion of male respondents belonged to large households. For example, 37% of male respondents belonged to a household size of 8 and above, while only 23% of female respondents belong to that group. The majority of both male and female respondents belong to a household size of 5–7 people. Overall, the household size of male and female respondents differs significantly ($\chi^2 = 8.754$, *p*-value = 0.033). The family structure of the respondents, however, was somewhat similar. Most of the male and female respondents were nucleus, i.e., 64%. Around 23% of male and female respondents were living in joint family structures. Only 10% of male respondents and 11% of female respondents were living in single accommodations.

A difference between male and female respondents was observed in terms of average monthly income. Around 31% of male respondents had an average monthly income of more than 100,000 PKR, while only 20% of females had this income level. There were 20% of male respondents and 23% of female respondents who had an average monthly income below 25,000 PKR. Overall, there was a significant difference in the

Table 3
Socioeconomic characteristics of male and female respondents.

Socioeconomic Characteristics	Classes	Male (n = 238)		Female (n = 141)		Chi-square Test	
		Freq.	%	Freq.	%	χ^2	p-value
Age	< 19	6	2.5	10	7.1	10.449	0.015
	19–28	145	60.9	97	68.8		
	29–37	50	21.0	23	16.3		
	>38	37	15.5	11	7.8		
Education	High school	1	4	2	1.4	1.230	0.541
	College	4	1.7	3	2.1		
	University	233	97.9	136	96.5		
Household size	<5	50	21.0	34	24.1	8.754	0.033
	5–7	100	42.0	74	52.5		
	8–10	54	22.7	24	17.0		
	>10	34	14.3	9	6.4		
Marital status	Single	156	65.5	103	73.0	5.165	0.160
	Married	78	32.8	36	25.5		
	Divorced/widowed	1	0.4	2	1.4		
	Prefer not to say	3	1.3	0	0		
Type of family	Single Accommodation	24	10.1	16	11.3	1.002	0.801
	Nuclear	152	63.9	90	63.8		
	Joint	55	23.1	33	23.4		
	Prefer not to say	7	2.9	2	1.4		
Average income (in PKR) ^a	<10,001	24	10.1	15	10.6	9.491	0.050
	10,001–25,000	23	9.7	17	12.1		
	25,001–50,000	59	24.8	29	20.6		
	50,001–100,000	59	24.8	52	36.9		
	>100,000	73	30.7	28	19.9		

^a 1 USD = 165.95 PKR (5th Sept, 2020).

level of income between both genders ($\chi^2 = 9.491$, p-value = 0.050). This shows that female respondents earn less than male respondents. Overall, the socioeconomic status of male and female respondents was different in terms of age, household size, and income.

4.2. Gendered COVID-19 risk perception

4.2.1. Fear

All the indicator values for the fear domain were found to be above average. Male and female groups reported slightly different fear and worries for COVID-19. Females were found to be more fearful and worried in all the mentioned aspects of the fear domain. A huge and significant difference between male and female responses was found for the likelihood of getting infected ($\chi^2 = 8.967$, p-value = 0.062), and fear-based on current knowledge on COVID-19 ($\chi^2 = 8.102$, p-value = 0.088) as indicated in Table 4). This suggests that women need more access to information to enhance their knowledge of the pandemic. Bish and Michie (2010) also suggested focusing on demographic-based communication mechanism could limit fear [46]. The perception about the disruption of daily lifestyle as well as the perceived danger to family and community was found to be very high among the male and female population. Overall, the perception of fear and worry for the COVID-19 pandemic was higher among females. This higher level of fear and worry among the female population may be associated with greater psychological vulnerability of pandemic outbreaks and a higher level of stress. These results are also supported by other studies (e.g. Refs. [44,47,48]). However, the findings did not collaborate with other research studies [49].

4.2.2. Behaviour

The mean values of behaviour and attitude indicators were also found to be above average. However, the female population perceives slightly lower capacities to deal with COVID-19 compared to the male population. The difference is found to be significant ($\chi^2 = 9.186$, p-value = 0.057). Lower capacities of the female population may be linked with a lower level of knowledge and income level. The perceived ability to change the lifestyle due to pandemic was found to be similar among the male and female populations. However, the perception of changing social relations (with relatives, friends, neighbours, and colleagues) was

slightly lower in female groups (mean value 3.0) compared to male groups (mean value 3.2). In Pakistan, social relations and networks with families and relatives are important, especially for females, and therefore the scores were slightly lower for females in Pakistan. This study is in agreement with the study by Galasso et al., 2020 [50].

4.2.3. Awareness

Awareness and knowledge of protection measures against pandemic and their associated risks shape the risk perception. The values of 'awareness and knowledge' indicators were found to be high both for male and female groups. This suggested that both male and female groups are highly familiar with the precautionary measures while the female population is slightly more familiar with protective measures than the male group. Clark et al. (2020) also found that female gender took more precautions than the male population in the case of COVID-19. However, both groups think that their communities are unprotected from the pandemic. Moreover, both groups think that COVID-19 is completely new for them, unaware of potential risks. Still, the female population was slightly less aware of unknown risks compared to a male population group. This suggests that communities are lacking preventive facilities and unaware of the unknown risk. Therefore, interventions are needed to enhance the knowledge of people and adopt appropriate gender-sensitive measures to limit pandemic spread.

4.2.4. Trust

Trust in government institutions is key in influencing the risk perception of communities. The values of all the indicators were found to be above average both for male and female groups. There are similarities and differences found for trust indicators among males and females. Both male and female trust the government provided pandemic related information in the same way. Similarly, no difference was seen among males and females regarding reliance on non-official information sources. This suggests that both groups do not rely on non-government information sources. Moreover, there is no difference based on gender regarding trust and confidence in science and technology to prepare a vaccine in one year. A significant difference of opinion between male and female groups was observed for trust in disaster management and public health agencies ($\chi^2 = 10.743$, p-value = 0.030), trust in disaster management policies and strategies ($\chi^2 = 17.516$, p-value = 0.002),

Table 4
Mean and standard deviation values of the indicators measuring risk perception in male and female groups.

Sr. No.	Domain and indicator	Male (n = 238)		Female (n = 141)		Statistical difference	
		Mean	SD	Mean	SD	χ^2	p-value
Dread, Fear, and Worry							
F-1	Perceived extent of fear to your life	2.773	1.146	2.744	1.155	1.396	0.845
F-2	Perceived likelihood of getting infected	2.416	1.252	2.780	1.342	8.967	0.062
F-3	Increased occurrence of infections	3.491	1.224	3.773	1.091	6.829	0.145
F-4	Disruption of daily lifestyle	4.033	1.186	4.184	1.105	1.634	0.803
F-5	Perceived danger to your family	3.848	1.141	4.106	1.033	6.643	0.156
F-6	Perceived danger to your community	4.214	1.079	4.255	0.966	5.746	0.219
F-7	Fear on the basis of current knowledge	3.479	1.196	3.709	1.059	8.102	0.088
F-8	Fear on daily needs/supplies interruption	3.390	1.202	3.496	1.073	7.069	0.132
Behaviour and Attitude							
B-1	Perceived incapacity to deal	2.735	0.968	3.014	0.978	9.186	0.057
B-2	Perceived adaptability of lifestyle	3.210	1.078	3.248	1.109	2.052	0.726
B-3	Change in relationships	3.172	1.272	3.035	1.375	4.296	0.367
Awareness and Knowledge							
A-1	Perceived extent of familiarity	4.109	1.008	4.269	.932	2.669	0.615
A-2	Perceived community unprotection	3.239	1.175	3.056	1.067	5.095	0.278
A-3	Awareness about unknown risks	4.344	0.984	4.248	1.015	4.392	0.355
Trust and Confidence							
T-1	Trust on information acquired from official sources	3.373	1.175	3.361	1.220	3.177	0.529
T-2	Non-reliance on information acquired from different non-official sources	3.529	1.081	3.581	1.128	6.446	0.168
T-3	Trust in disaster management and public health agencies	3.689	1.119	4.035	1.017	10.743	0.030
T-4	Trust in disaster management policies and strategies	3.079	1.224	3.524	1.131	17.516	0.002
T-5	Trust in the information given by the local government	2.983	1.194	3.595	1.055	24.884	0.000
T-6	Trust in response by the provincial or federal government	3.058	1.196	3.425	1.231	9.985	0.041
T-7	Trust in science and experts	3.630	1.234	3.588	1.146	2.366	0.669

trust in information given by the local government ($\chi^2 = 28.884$, p-value = 0.000), and trust in response by the provincial or federal government ($\chi^2 = 9.985$, p-value = 0.041). Results suggested that compared to male groups, female groups trust more in government institutes like disaster management and public health departments, local governments, responses of provincial and federal governments to deal with the COVID-19 situation [36]. also maintained that the female population has more trust in government-related institutions and their initiatives compared to the male population. Thus, the trust dimension of risk perception differs significantly when considering gender aspects.

4.2.5. Overall risk perception

Overall, both males and females perceive COVID-19 risk differently. The results underscored that females perceived risk more than the male population in various dimensions of risk perception. In terms of fear, the female population group was found to be more afraid (3.63) compared to males (3.45). The T-test has also confirmed it and indicated a significant difference (see Table 5). Behaviour and attitude towards COVID-19 were found to be similar for both males (3.03) and females (3.09). The perceived extent of awareness and knowledge of precautionary measures to reduce COVID-19 risk were also found to be the same among the male (3.89) and female (3.85) population. The trust and confidence dimension of risk perceptions differs between males (3.33) and females (3.60). Table 5 depicts that perception of trust and confidence was more among female groups compared to male groups. Overall, the female population perceived a higher risk of COVID-19 compared to male groups. The difference is found to be significant (see Table 5). The female population fear and worry more because of the pandemic, and they trust more in government actions, which may have resulted in higher risk perception. The results are supported by other studies (e.g. Refs. [44,51,52]).

4.3. Gendered coping mechanisms

4.3.1. Problem

Out of the six indicators investigated under the problem-oriented domain of the coping mechanisms, the difference between the gender classes has been found significant only for the indicator of 'I feel safe in my own home' ($\chi^2 = 9.674$, p-value = 0.046) (Table 6). The associated 'means of the responses reveal that females (4.652) felt safer while staying at home as compared to the males (4.378) during the COVID-19 pandemic. The cultural elements and influences might also have played a role in having such a gender-sensitive response. One's own home space is generally perceived safer for females in comparison to the outdoor spaces in Pakistani society, which also makes them less mobile and more dependent on the male members of their households in meeting their traveling needs (Ahmad, 2018; Masood, 2018). Though all other indicators have been found insignificant with the gender difference, their associated mean values still provide some clue to gender influence on the problem-oriented domain of the coping mechanisms. Except for the last indicator under this domain, i.e. 'I am seeking financial support from the government', all other indicators had higher mean values for females as compared to the males, which gives some hint that females were more

Table 5
Gender-based differences in risk perception and its domains.

Risk perception	Male		Female		Statistical difference	
	Mean	SD	Mean	SD	t-test ^a	p-value
Fear	3.455	0.744	3.631	0.635	-2.580	0.011
Behaviour	3.039	0.600	3.099	0.615	-1.284	0.201
Awareness	3.897	0.654	3.858	0.596	0.151	0.88
Trust	3.334	0.727	3.587	0.649	-2.489	0.014
Risk Perception	3.419	0.438	3.573	0.380	-3.306	0.001

^a Negative (-ve) values imply that the latter group (females) perceives risk more than the former group (males).

Table 6
Mean and standard deviation values of the indicators measuring coping mechanisms in male and female groups.

Sr. No.	Domain and indicator	Male (n = 238)		Female (n = 141)		Statistical difference	
		Mean	SD	Mean	SD	χ^2	p-value
Problem-oriented							
P-1	<i>I feel safe in my own home</i>	4.378	0.967	4.652	0.726	9.674	0.046
P-2	<i>I listen to the experts and follow their advice</i>	4.310	0.829	4.439	0.813	3.961	0.411
P-3	<i>I actively seek out new information about the current situation.</i>	4.063	1.002	4.148	0.977	1.070	0.899
P-4	<i>I am doing something completely new that I would never have done in other circumstances</i>	3.689	1.2238	3.744	1.142	4.253	0.373
P-5	<i>I talk to someone who knows about it</i>	3.302	1.169	3.510	1.268	6.881	0.142
P-6	<i>I am seeking financial support from the government</i>	1.987	1.335	1.766	1.174	4.841	0.304
Emotion-oriented							
E-1	<i>I turn to my work or other activities to distract myself</i>	3.512	1.164	3.503	1.318	11.244	0.240
E-2	<i>I actively seek meditation to calm myself</i>	2.684	1.410	2.844	1.390	2.369	0.668
E-3	<i>It will emerge over time; there is nothing more to do but wait.</i>	3.668	1.195	3.907	1.101	8.668	0.070
E-4	<i>I hope for a miracle</i>	3.411	1.374	4.205	1.038	34.704	0.000
E-5	<i>I try to make myself feel better by eating, smoking, or taking medication</i>	2.525	1.373	2.914	1.471	8.007	0.091
E-6	<i>I refrain from things that can trigger bad moods</i>	3.470	1.224	3.503	1.216	0.376	0.984
E-7	<i>I refuse to believe what is happening.</i>	2.092	1.228	1.954	1.185	1.442	0.837
Action-oriented							
BE-1	<i>I wash my hands more than usual</i>	4.344	0.922	4.3055	0.885	3.958	0.412
BE-2	<i>I avoid going out unnecessarily</i>	4.521	0.957	4.645	0.820	3.211	0.523
BE-3	<i>I avoid public spaces and transport</i>	4.634	0.824	4.645	0.879	1.322	0.585
BE-4	<i>I have bought disinfectants (soap, sanitizers, etc.) more than usual</i>	3.016	1.371	3.163	1.442	5.800	0.215
BE-5	<i>I have bought staple foods (flour rice, lentils, meat, etc.) more than usual</i>	2.718	1.305	2.922	1.429	5.069	0.280
BE-6	<i>I have bought protective equipment (masks, gloves, etc.) more than usual</i>	2.600	1.254	3.113	1.389	16.393	0.003

active than the males for opting the problem-oriented coping strategies during the COVID-19 pandemic.

4.3.2. Emotion

Out of the seven indicators listed under the emotion-oriented domain of coping mechanisms, the indicators of 'It will emerge over time; there is nothing more to do but wait' ($\chi^2 = 8.668$, p-value = 0.070), 'I hope for a miracle' ($\chi^2 = 34.704$, p-value = 0.000) and 'I try to make myself feel better by eating, smoking, or taking medication' ($\chi^2 = 8.007$, p-value = 0.091) have been found significant with the gender difference. The associated mean values reflect that females were more concerned with opting for emotions-oriented coping strategies in response to the Covid-19 pandemic than the males. These findings also reflect on the mental construct of the females in Pakistani society, where they were more dependent on the male members of their households for carrying out many of their outdoor activities [53]. Such dependence generates a mindset that hinders taking initiatives rather than encourages waiting for the needed support or for things to happen. Likewise, waiting for miracles to happen is another offshoot of the same mindset, while males, more active in taking initiatives, believe less in miracles as the panacea to crises. Also, females were better at controlling their emotions by diverting their focus on food or medicine intake. Pakistani culture mainly assigns the cooking and housekeeping duty to the female members of the households, which also turns out to be a pastime hobby for many females. That is why females were found more indulged in eating habits as a remedy to distract themselves from COVID-19 related fear and anxiety. All other indicators under the emotion-oriented domain of the coping mechanisms have been found insignificant for the gender difference. Though insignificant, males found to have slightly higher 'mean' values than females for only two indicators, which are 'I turn to my work or other activities to distract myself' and 'I refuse to believe what is happening'. The majority of the labour force in Pakistan consists of males, thus keeping themselves busy in the work-related activities turned out a coping strategy practiced more by the males. Also, having more exposure to the outdoor space enabled the male members to observe normal routines during the COVID-19 crisis time, making them less susceptible to believing in the restrictive measures going around in response to the COVID-19 pandemic. Overall, a significant difference was seen between males and females in the emotion-oriented domain. This result was consistent with the study of Gerhold (2020).

4.3.3. Action

There were six indicators in total which were investigated under the action-oriented domain of the coping mechanisms, and only the indicator of 'I have bought protective equipment (masks, gloves, etc.) more than usual' ($\chi^2 = 16.393$, p-value = 0.003) has been found significant with the gender difference. The associated mean values reflect that females were more active than males in adopting this specific action-oriented strategy. As reported in section 5.3.2, males found to be less prone to believe about the events happening around, including the restrictive measures during the COVID-19 pandemic. They were found less active than females in buying protective equipment. All other indicators have been found insignificant for the gender difference. However, the mean values of all other indicators except one have been found higher for females than males, which provides a clue that females were more active than males in adopting action-oriented strategies in response to tackle the consequences of the COVID-19 pandemic.

4.3.4. Overall coping mechanism

Combining the results of all the coping mechanism domains provided integrated values for the overall coping mechanisms being practiced by the respondents of the study during the COVID-19 pandemic. The t-test values for all the domains of the coping mechanisms have been found significant (Table 7) with negative values which show that the females (coded 2) opted for the coping strategies more than the males (coded 1) during the COVID-19 pandemic. The overall coping mechanism also bears the same result concerning the significance (p-value 0.003) and gender difference of adopted coping strategies (-3.079). The 'mean' values of all the domains and consequently the overall coping

Table 7
Gender-based differences in coping mechanism and its domains.

Coping Mechanism	Male		Female		Statistical difference	
	Mean	SD	Mean	SD	t-test ^a	p-value
Problem-oriented	3.621	0.625	3.710	0.647	-1.896	0.060
Emotion-oriented	3.052	0.681	3.261	0.695	-2.213	0.029
Action-oriented	3.639	0.712	3.799	0.755	-2.683	0.008
Overall coping mechanism	3.417	0.482	3.573	0.510	-3.079	0.003

^a Negative (-ve) values imply that the latter group (females) coping mechanism more than the former group (males).

mechanism were also higher for females than males. Overall, investigating the gender aspect of the coping mechanisms reveals that females were more active in adopting coping strategies than males.

4.4. Impact of gender on risk perception and coping mechanism

The results of linear regression analysis confirm that risk perception and coping mechanisms are significantly associated with the variable of 'gender' (Table 8). Before interpreting the results of the generated regression models, it is important to report on the goodness-of-fit of these models. The F values of both generated models of risk perception (3.01 > 1) and coping mechanisms (4.98 > 1) have been found significant (p values are 0.083 and 0.026 respectively), thus show that the generated models are a good fit for the collected data and the results can reliably be interpreted from the generated models. If we see the values that the risk perception and coping mechanism models have generated, it comes out that though gender is significantly associated with the risk perception and coping mechanism, however, the effect of this correlation is small. According to the generated models, gender can explain only 0.79% of the variance in risk perception and 1.3% variance in the coping mechanism. Though small, but for a single variable contributing to the overall risk perception and coping mechanisms, these results are still significant. Risk perception and coping mechanisms are the mental constructs that are made up of so many variables, and gender is also one of them. According to the literature findings, the risk perceptions and coping mechanisms are significantly related to many variables, including income [54], education [32], age [44,55,56], behaviour [57] and gender [5,21,34,58,59]. Moreover, there are sufficient studies that show a clear relationship of gender with income [60], education [61] and mobility pattern [62], etc. particularly in the developing countries that show an interplay of gender with various other variables significantly associated with risk perception and coping mechanisms. If viewed in such a broader perspective, gender plays an important role in developing the risk perceptions and the adopted coping mechanism strategies.

The positive values of the generated models suggest a positive relationship between gender and risk perception and coping mechanisms. It means when the gender is changed from male (coded 1) to female (coded 2), the risk perception and coping mechanism values are increased. It simply implies that females perceived COVID-19 related risks more than males and consequently were found more active in adopting coping mechanism strategies than males. This finding confirms some of the past studies [6,36]. The mathematical formulation of the generated models helped to deduce the change in the values of outcome variables, i.e., risk perception and coping mechanisms with a unit change in the predictor value. When the gender is changed from male to female in the generated models, the values for risk perception is increased by 2.26%, while it causes an increase of 3.41% in the value of coping mechanisms. These are the significant variations in the results of risk perception and coping mechanisms with respect to gender, and thus confirm the significant role of gender in developing the risk perception and coping mechanisms of the target population under investigation.

5. Conclusions

It has become apparent that COVID-19 will now be a part of human lives, and would change personal and work lifestyles for at least some years. In this context, risk perception and coping mechanisms are important for surviving in a pandemic situation. This study reviews current gender-based knowledge on COVID-19 in Pakistan. Using established methodologies, risk perception and coping mechanisms have been quantified. Statistical tests have confirmed significant differences in fear and trust domains of risk perception. Moreover, it has also been ascertained that men and women responded differently in coping with the pandemic. This study also concludes that the role of gender (among other variables) is significant in developing the risk

Table 8

Impact of gender on risk perception and coping mechanism using a simple linear regression model.

Independent variables	Model 1 Risk perception	Model 2 Coping mechanism
Gender	0.078* (0.045)	0.117** (0.053)
Constant	3.369*** (0.065)	3.314*** (0.077)
Goodness-of-fit	F = 3.01*, R ² = 0.0079	F = 4.98**, R ² = 0.013

Note: Standard errors are in parenthesis; significant at *p < 0.1, **p < 0.05, ***p < 0.001.

perception and coping mechanisms for the society. It further concludes that females perceived risks associated with the COVID-19 pandemic more than the males, and thus, were more active in practicing prevention in response to the pandemic. It is an important finding which can steer the government policy response towards tackling the pandemic crisis. The awareness campaigns for risk communication needs to target male members of the society more to increase their understanding of the severity of this crisis, and to act more seriously to tackle the pandemic situations. In short, this study advocates the integration of gender components in tailoring future pandemic risk communication and reduction strategies.

Risk perception is tricky to quantify as a myriad of factors influences it – this presents some limitations. The use of a non-probability sampling technique limits the analysis for generalization for a larger population. Moreover, the sampled population was mostly educated with access to the internet. Thus, for making a more robust analysis, socioeconomically diverse samples are needed to widely confirm gender influence on risk perception and coping mechanisms. More advanced statistical techniques can be adopted to rigorously test other hypotheses in the future. It is also proposed to examine the role of spatial aspects and sociocultural norms in shaping the COVID-19 risk perception. Further, the function of media and relevant institutions, and their risk communication strategies need to be studied in more detail.

Nevertheless, this research, despite not encompassing a socioeconomically diverse and large sample due to the limitations posed by COVID-19, helps in understanding the pandemic risk from a gender perspective. The study highlights different domains of risk perception and coping mechanisms, which can help disaster managers, public health experts, policymakers, and related social scientists to reduce pandemic risk and introduce effective public interventions. Without incorporating the gender perspective, risk-informed COVID-19 communication will remain incomplete, and any preparedness initiatives taken will be more likely to fail.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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