

Farmers' Intention to Protect Livelihood in Coping with COVID-19, Application of the Protection Motivation Theory

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Original Research Abstract

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COVID-19 has rapidly developed into a global pandemic, causing the loss of many jobs, incomes, savings, and production activities. The pandemic has affected farmers' livelihoods due to a lack of access to health services, labor, and markets for agricultural products. Several studies have been conducted on the management and containment of the pandemic; however, the impact of COVID-19 on farmers' livelihoods has not been well documented. In this survey, using a sample of 180 farmers from Meshkinshahr County, Iran, the protection motivation theory (PMT) was used to model farmers' intention to protect their livelihoods in coping with COVID-19. The five constructs of the model showed significant effects and explained 88.5% of the variance in intention. Intention, in turn, explained 48.4% of the variance in behavior. While farmers demonstrated a strong intention to protect their livelihoods (mean = 3.86), their protective actions remained weak (mean = 2.79). This gap likely resulted from their first-time exposure to the pandemic, insufficient health literacy, and restricted access to extension services that could support income diversification. Extension courses are essential measures to promote farmers' self-efficacy. The findings suggest how health planners and extension services can design outreach programs that use health information for decision-making and diversify farmers' sources of income.

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INTRODUCTION

The coronavirus (COVID-19) has spread rapidly around the world, developing into a global pandemic (Wang et al., 2020). It has led to a decline in production activity and travel, with home quarantines imposed worldwide (Bashirian et al., 2020). The pandemic has also changed people's eating, shopping, and interaction behaviors

related to food, shifting them toward healthier diets and domestic products due to food safety concerns (Ghasemi et al., 2019). COVID-19 is therefore first and foremost a human disaster, placing millions of lives at risk (Burdorf., 2020) and triggering widespread changes across social, economic, and cultural dimensions. What began as a medical event has thus evolved into a socio-economic challenge.

The shock of the disease has been severe for Iran as well, inflicting significant damage on the country's economy (Asegie et al., 2021). National restrictions aimed at managing and containing the pandemic have limited many forms of work, placing a considerable economic burden on a large portion of society (Wang et al., 2021, Bashirian et al., 2020). Due to poor infrastructure and high poverty rates in rural areas, the pandemic has led to high unemployment, depletion of savings and relief resources, lower incomes for daily laborers, and disruptions in marketing systems (Bukari et al., 2022). Therefore, it is crucial not only to address the socio-economic consequences of the pandemic in rural areas but also to intensify efforts to control the disease.

While a considerable body of literature on COVID-19 exists, it has largely focused on macro-level management and containment of the disease (Aromolaran & Muyanga, 2020). Studies examining the impact on farm household livelihoods remain limited. Previous research has shown that local food production decreased due to the cessation of certain agricultural activities (Bashirian et al., 2020). In addition, the pandemic affected farming families by reducing labor availability, increasing costs, and lowering sales of agricultural products (Khatri et al., 2023, Griffin et al., 2022). found that while the pandemic had a limited impact on subsistence agriculture, it posed significant challenges to emerging semi-commercial agriculture

and off-farm incomes, leading to greater reliance on locally produced food. Therefore, understanding farmers' livelihood protection behaviors in the face of COVID-19 is crucial. Understanding the intentions behind people's behavior enables policymakers to plan for appropriate behavioral change (Rogers, 1983).

The Protection Motivation Theory (PMT) (Soon et al., 2022) has been widely used as a framework for examining how motivation influences health behaviors. According to PMT, individuals make two key appraisals when confronted with a health threat: threat appraisal and coping appraisal. Threat appraisal involves assessing one's perceived vulnerability to the threat and the perceived severity of the threat, which together increase the likelihood of engaging in protective behaviors. Coping appraisal evaluates the effectiveness of the recommended protective behavior (response efficacy), one's own ability to carry it out (self-efficacy), and the costs associated with taking action (response costs) (Rogers, 1983, Boer & Seydel, 1996, Xiao et al., 2021). These appraisals can lead to either adaptive or maladaptive responses. When individuals perceive a health threat as both severe and personally relevant, their level of fear increases, motivating them to adopt protective behaviors. During global pandemics such as COVID-19, anxiety and fear were heightened by the awareness that no definitive cure existed for the disease (Lahiri et al., 2021).

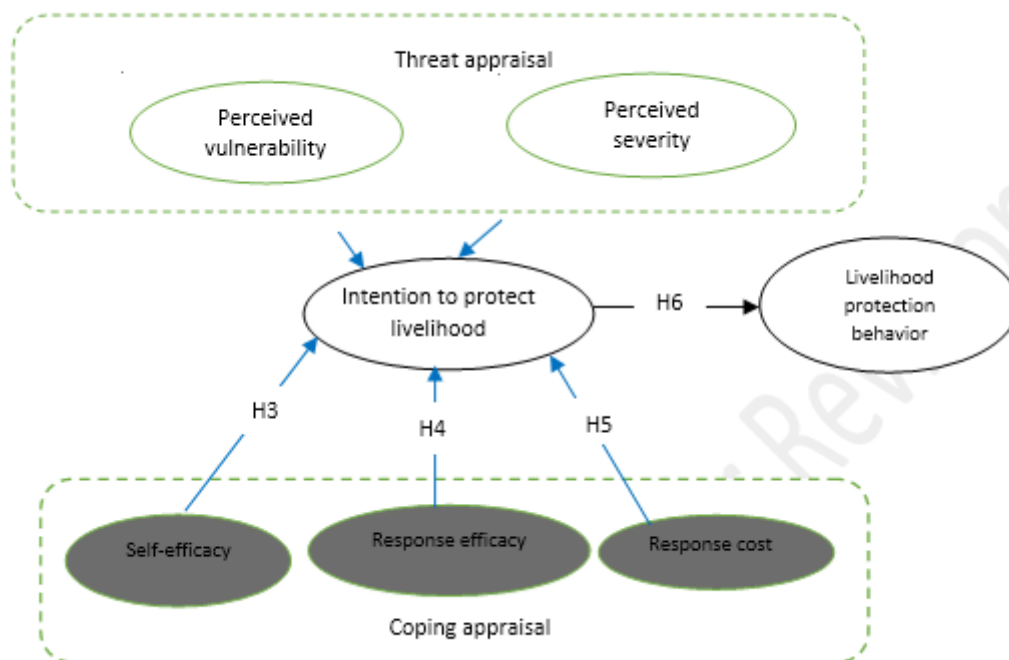


Figure 1. Theoretical Framework (Livelihood Threat and Coping Appraisal - PMT)

Several studies have applied the Protection Motivation Theory (PMT) to explain health-related behaviors during the COVID-19 pandemic, including prevention practices (Stangier et al., 2022), dietary supplement purchasing (Ansari-Moghaddam et al., 2021), food safety behaviors (Boer & Seydel, 1996), and vaccination intentions (Rogers, 1983, Bagherzadeh et al., 2021). However, research remains scarce on the pandemic's impact on rural household livelihoods, and no known PMT study has yet been used to predict farmers' livelihood protection behaviors in response to COVID-19.

Therefore, this study aims to apply the PMT framework to investigate farmers' intention to protect their livelihoods from the effects of COVID-19. Specifically, it examines how farmers' threat appraisals—perceived vulnerability and perceived severity—influence their motivation to adopt protective strategies. It also explores the role of coping appraisals, including self-efficacy and response efficacy, alongside the potentially constraining effect of perceived response costs. Finally, the study assesses whether these cognitive appraisals translate into actual protective behaviors aimed at safeguarding their livelihoods.

METHODOLOGY

Study area

This cross-sectional survey was conducted from 2022 to 2023 in Meshkinshahr County, located within Ardabil Province, Iran. The county comprises four administrative districts (Central, East, Arshq, and Muradlo), which are further subdivided into 12 rural districts (Dehestans) and six urban areas (Muradlo, Razey, Fakhrabad, Lahrud, Aleni, and Kasaba). The region encompasses a total of 270 villages, where agriculture serves as the primary livelihood for all households. Climatically, the area is characterized by cold conditions, with an average annual temperature of 9.5°C (ranging from a minimum of −15°C to a maximum of 18°C). The main agricultural crops cultivated in the region are fodder and cereals. In terms of horticulture, apples and grapes represent the most significant products, with apple orchards alone covering over 7,000 hectares and yielding approximately 90,000 tons annually.

Population, sample, and research instrument

The statistical population comprises all farmers (heads of households) in the region. A sample of 180 people was selected using the Cochran sampling formula. The

multi-stage cluster sampling method was used for data collection. For this purpose, two Dehestans (rural groups) were selected from each district, and four villages were selected from each Dehestan, resulting in a total of 32 villages. The sample size for each village was determined based on its population.

After a literature review (Rogers, 1983, Soon et al., 2022, Xiao et al., 2021, Lahiri et al., 2021, Stangier et al., 2022, Ansari-Moghaddam et al., 2021), a Protection Motivation Theory (PMT) questionnaire was adapted based on the study's objectives and used for data collection. The questionnaire consisted of two main parts. The first part focused on the demographic characteristics of the respondents, while the second part contained seven PMT constructs. Threat appraisal was assessed using two constructs: perceived severity (5 items) and perceived vulnerability (6 items). Coping appraisal was evaluated using three constructs: perceived response efficacy (3 items), perceived self-efficacy (4 items), and response costs (6 items). The intention to protect livelihood and livelihood protection behaviors were measured using 5 and 7 items, respectively. Respondents rated all items on a 5-point Likert scale ranging from very low (1) to very high (5).

Data analysis

Structural equation modeling was performed using partial least squares (PLS-SEM) to examine the relationships between the research variables. The measurement model's goodness of fit was assessed with appropriate indices. Reliability was evaluated using Cronbach's alpha and composite reliability (CR) coefficients, and discriminant validity was assessed through convergent and divergent validity measures. Following (Hair, 2006), CR values above 0.7 indicate good reliability, while values between 0.6 and 0.7 are considered acceptable. Construct validity is deemed adequate when the average variance extracted (AVE) exceeds 0.5 (Hair, 2006). The AVE represents the proportion of variance in a construct explained by its indicators (Fornell & Larcker, 1981). Discriminant validity was assessed using the and the heterotrait-monotrait (HTMT) ratio of correlations (Henseler et al., 2015).

The HTMT quantifies the average correlation between indicators of different constructs relative to the average correlation among indicators of the same construct. The exact threshold value for establishing discriminant validity is debated; some authors recommend a cutoff of 0.85, while others suggest 0.90. According to, HTMT scores exceeding this threshold indicate a lack of acceptable discriminant validity.

RESULTS

Demographic

Based on the results, respondents were middle-aged (48.90 ± 14.28 years) and had an average of 32.86 ± 16.55 years of farming experience. Among them, 12.2% were women, and 87.8% were men. The majority (81.7%) lived in villages, while 18.3% lived in urban areas. Most respondents were married (96.1%), with 3.9% being single. Regarding health status during the pandemic, 24.4% had experienced severe COVID-19 infection at least once, while the remaining respondents were either uninfected or had only mild cases. In terms of education, 35.6% had completed primary or secondary school, 41.1% held a diploma, and 23.3% had a college degree. Household size varied, with 75% of respondents having 3 to 6 family members. Pre-existing medical conditions that increased susceptibility to COVID-19 were reported by 41.1% of respondents. Additionally, 10% had taken livelihood loans to cover living expenses during the pandemic.

Evaluation of the PMT Constructs

The model was assessed based on threat appraisal and coping appraisal. The threat appraisal results indicated that respondents perceived the severity of COVID-19 as high (mean = 3.92) and considered themselves relatively vulnerable to the disease (mean = 3.19). Among the items measuring perceived severity, the statement “Consumption of local produce has increased to support the family’s livelihood” ranked highest (mean = 4.2), followed by “The COVID-19 crisis has had the most negative impact on my farming activities” (mean = 4.17). Respondents noted that consuming local products served as a strategy to secure their livelihood. The pandemic’s adverse effect on agriculture also led some farmers to seek other employment, migrate to urban areas, and, in some cases, involve their children in labor. Within the perceived vulnerability construct, the items “Decline in the supply of essential medicines during COVID-19” (mean = 4.18) and “Impact on markets for agricultural products and farmers’ financial strength” (mean = 3.92) received the highest ratings. The coping appraisal was evaluated using three constructs: response costs, response efficacy, and self-efficacy. Respondents perceived that COVID-19 imposed high response costs (mean = 3.85) and rated response efficacy as high (mean = 3.85), but reported a lack of self-efficacy (mean = 2.53). Among response cost items, “I have reduced my traveling to the

cities” ranked first (mean = 4.26), followed by “Due to my inability to support myself, I rely on my savings” (mean = 4.24). For response efficacy, the highest-rated item was “Access to credit reduces the negative impact of food insecurity during COVID” (mean = 4.21), followed by “Ability to meet household needs by obtaining funds from loan funds” (mean = 3.92). Regarding self-efficacy, the low mean score (2.53) suggests that farmers felt insufficiently able to protect themselves from COVID-19. Overall, respondents expressed strong motivation to protect their livelihood from COVID-19 (mean = 3.86), but their actual protective behavior during the pandemic was relatively weak (mean = 2.79). In terms of intention to protect livelihood, the highest-rated item was “Intention to raise livestock and poultry to support my family’s livelihood” (mean = 4.42), followed by “Intention to support my family with my savings” (mean = 4.28). By contrast, the highest-rated livelihood protection behavior was “Raising livestock and poultry for family consumption” (mean = 3.74), followed by “I have used subsistence packages during COVID-19” (mean = 3.64). The lowest-rated protective behavior was “I have reduced food waste at the family table” (mean = 2.04). This low score may be due to farmers generally producing little food waste; when waste does occur, it is often repurposed for livestock or poultry consumption (see Table 1).

Relationships between the research constructs

The PLS-SEM results demonstrated that all Cronbach’s alpha and CR values exceeded 0.7. Additionally, all AVE values were within acceptable limits, and the factor loadings met the recommended thresholds (Table 2).

The results also indicated that the six constructs—perceived severity ($\beta = 0.525$), perceived vulnerability ($\beta = 0.259$), response efficacy ($\beta = 0.508$), self-efficacy ($\beta = 0.320$), and response costs ($\beta = -0.433$)—collectively explained 88.5% of the variance in intention. Intention, in turn, explained 50.9% of the variance in behavior (Table 3).

Perceived severity was the strongest predictor of intention, followed by response efficacy. Furthermore, the factor loadings showed that items within these constructs had positive and significant effects on intention, while the factor loadings of the intention items themselves significantly and positively influenced behavior.

Based on the results of Table 4, all HTMT values fall within the acceptable threshold.

Table 1. Item scores of constructs of livelihood protection motivation

Variables	Items	Mean	SD
Perceived severity Mean: 3.92 SD: 0.77	Since COVID-19, the consumption of local products has increased to support the family's livelihood	4.2	0.85
	The COVID crisis has had the most negative impact on my farming activities	4.17	0.87
	I have engaged in other income-generating jobs to support the livelihood of my family	3.92	0.933
	Due to the inability to provide a livelihood in the village, many villagers migrate to cities	3.84	0.996
	Due to the inability to provide for the family's livelihood, I send my children to work	3.64	1.14
Perceived Vulnerability Mean: 3.19 SD: 0.79	Essential medicines have decreased during COVID-19	4.18	0.77
	COVID affected the agricultural product markets and weakened my financial ability	3.92	0.90
	Regardless of economic status, the lives of all villagers have been exposed to danger	3.70	0.76
	COVID reduced agricultural incomes and increased unemployment in rural areas	2.60	1.19
	Due to increased food prices, I had to reduce my food consumption.	2.45	1.23
	The access to essential items of food has been dramatically reduced	2.31	1.23
Response cost Mean: 3.85 SD: 0.67	Since COVID-19, I have reduced my travel and commuting to the city.	4.26	0.63
	Since COVID-19, due to my inability to support myself, I rely on my savings.	4.24	0.76
	Since COVID-19, I have started consuming local products.	4.16	0.84
	Since COVID-19, due to the decrease in my job income, I can hardly support my family.	3.81	0.95
	Due to the treatment costs of the pandemic, it has become difficult to support my family	3.78	0.90
	Since COVID-19, due to livelihood problems, I have been forced to receive financial aid and take loans.	3.40	1.16
Response efficacy Mean: 3.85 SD: 0.77	Access to credits reduces the adverse effects of food insecurity during COVID-19.	4.21	0.81
	During COVID-19, it is possible to meet household needs by receiving funds from credit funds.	3.92	0.79
	During COVID-19, it is possible to meet the family's living needs by borrowing from friends.	3.43	1.07
Self-efficacy Mean: 2.53 SD: 0.78	I can protect the livelihood of my family during COVID-19	3.2	1.11
	During COVID-19, I can provide the basic food needs of my family	3.05	0.99
	During COVID-19, I can provide for my family's livelihood needs by diversifying sources of income	2.23	1.04
	During COVID-19, I can engage in additional income-generating activities	2.10	0.95
Intention to protect the livelihood Mean: 3.86 SD: 0.57	I intend to raise livestock and poultry to meet the livelihood needs of my family	4.42	0.81
	I intend to support my family with my savings during COVID-19	4.28	0.74
	I am planning to get a livelihood loan to make a living for my family	4.16	0.86
	I intend to provide for my family's living needs by liquidating my assets during COVID-19.	4.13	0.80
	I intend to borrow money from my friends to meet the basic needs of my family	3.31	0.92

Table 1. Item scores of constructs of livelihood protection motivation(Continued)

Variables	Items	Mean	SD
Livelihood protection behavior Mean: 2.79 SD: 0.67	During COVID-19, I raise livestock and poultry for family use.	3.74	0.94
	I used subsistence packages During COVID-19.	3.64	0.95
	I used warm meals During COVID-19.	2.69	1.13
	During COVID-19, I borrowed from friends and maintained cash flow to support my family's living needs	2.55	0.86
	To prevent food insecurity during COVID-19, I used government cash grants.	2.54	0.85
	During COVID-19, we reduced the amount of our meals by adjusting our diet to deal with the disruption in access to food.	2.33	0.99
	I reduced the food waste at the family table during COVID-19	2.04	1.06

Table 2. Validity and reliability coefficients model

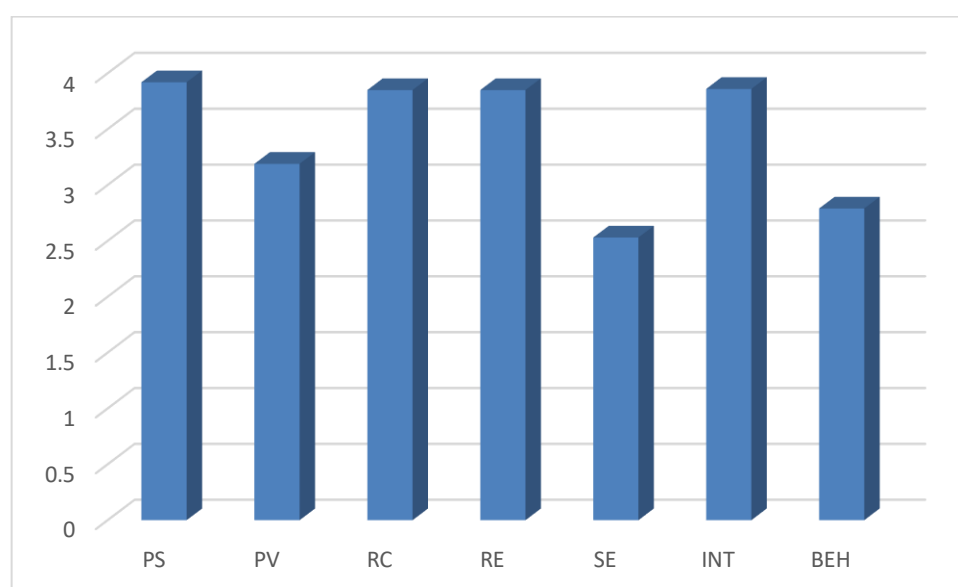
Variable	Item	Factor loading	Indices	Variable	Item	Factor loading	Indices
Perceived severity	PS1	0.546	Alpha=0.879 CR=0.914 AVE=0.686	Response efficacy	RE1	0.947	Alpha=0.860 CR=0.915 AVE=0.782
	PS2	0.815			RE2	0.845	
	PS3	0.926			RE3	0.858	
	PS4	0.952					
	PS5	0.839					
Perceived vulnerability	PV1	0.773	Alpha=0.768 CR=0.863 AVE=0.597	Self-efficacy	SE1	0.975	Alpha=0.848 CR=0.832 AVE=0.544
	PV2	0.735			SE2	0.771	
	PV3	0.655			SE3	0.971	
	PV4	0.860			SE4	0.558	
	PV5	0.823					
	PV6	0.774					
Intention to livelihood protection	INT1	0.770	Alpha=0.742 CR=0.832 AVE=0.527	Livelihood protection behavior	BEH1	0.886	Alpha=0.830 CR=0.870 AVE=0.504
	INT2	0.735			BEH2	0.627	
	INT3	0.590			BEH3	0.666	
	INT4	0.829			BEH4	0.571	
	INT5	0.828			BEH5	0.869	
					BEH6	0.612	
					BEH7	0.633	

Table 3. Results of the evaluation of the model

Dependent Variable	Independent Variable	t-value	β	R ²
Livelihood protection intention	Perceived severity	9.093**	0.525	0.873
	Perceived Vulnerability	2.811*	0.259	
	Response cost	5.276**	-0.433	
	Self-efficacy	5.992**	0.320	
	Response efficacy	8.851**	0.508	
Livelihood protection behavior	Livelihood protection intention	21.831**	0.714	0.509

Table 4. HTMT index of the model

Var.	1	2	3	4	5	6	7
Response efficacy (1)	0.782						
Severity (2)	0.650	0.686					
Vulnerability (3)	0.572	0.588	0.597				
Response cost (4)	0.533	0.548	0.556	0.560			
Motivation (5)	0.380	0.406	0.418	0.443	0.527		
Self-efficacy (6)	0.267	0.325	0.329	0.338	0.363	0.544	
Behavior (7)	0.218	0.223	0.225	0.239	0.255	0.258	0.504

**Figure 2.** Mean scores of livelihood protection constructs

DISCUSSION

Although numerous studies have explored the management and containment of the pandemic (Andarge et al., 2020), few have addressed the impact of COVID-19 on farming households' livelihoods (Bukari et al., 2022, Khatri et al., 2023, Griffin et al., 2022). Moreover, to date, no study has examined this issue within the context of the Protection Motivation Theory (PMT). The results indicate that all hypothesized relationships in the model were supported, with the five PMT constructs accounting for 88.5% of the variance in the intention to protect livelihoods. A significant positive relationship was also observed between intention and protective behavior, which explained 50.9% of the variance in livelihood protection behaviors (Andarge et al., 2020, Mortada et al., 2021, Hale et al., 2022). This finding aligns with prior research demonstrating that intention serves as a key precursor to behavior. Taken together, these results underscore the utility of PMT in predicting

farmers' livelihood protection intentions during a pandemic.

Given PMT's explanatory power for preventive behaviors, this theoretical framework can inform the design of interventions aimed at promoting such behaviors across diverse populations. The findings also offer valuable insights for health planners and policymakers in developing educational programs. Despite respondents' strong motivation to protect their livelihoods, their actual protective behaviors remained limited. Key barriers to translating intention into action included inadequate knowledge, insufficient infrastructure, lack of rural health education and insurance coverage, and weak extension services—particularly for subsistence farmers. As this was their first encounter with a pandemic, farmers were not fully prepared to adopt appropriate coping strategies. Nonetheless, they expressed a high motivation to improve their preparedness for future crises. Effective planning by health and agricultural policymakers is

therefore essential to support farmers in protecting their livelihoods during such events (Andarge et al., 2020, Pu & Zhong, 2020).

Livestock and poultry production ranked highest among both intended and actual protective livelihood measures. Accordingly, extension services should focus on providing training to improve rural livestock and poultry management. In addition, subsistence packages and low-interest government loans were identified as critical livelihood-support mechanisms. Rural development authorities should prioritize providing emergency and low-interest loans, along with subsistence packages, especially to resource-poor farmers who lack financial access.

Respondents perceived themselves as relatively vulnerable to the pandemic. Their most significant concerns within the domain of perceived vulnerability were the lack of medical care and the loss of agricultural markets—both of which weakened their financial base. COVID-19 exacerbated existing challenges in accessing medical services, especially for residents of remote villages. This shortage of rural healthcare during the pandemic aligns with findings from prior research (Pu & Zhong, 2020). Furthermore, studies have documented the severe impact of COVID-19 on agricultural markets and the economic stability of rural communities (Swinnen & McDermott, 2020, Harris et al., 2020, Mueller et al., 2021), imposing significant hardship on employment and livelihoods. This resulting economic vulnerability can, in turn, deter farmers from adopting protective health measures (Sadri et al., 2022). Compounding this issue, rural populations often exhibit lower health literacy, which impairs their ability to understand and act on health information during crises (Pu & Zhong, 2020).

Given the high perceived severity of COVID-19 and constraints on labor availability, some farmers reported an increased reliance on child labor. Notably, other research suggests that small and micro-enterprises, often dependent on family labor, were somewhat less impacted than larger industries (Bukari et al., 2022). This highlights the potential resilience inherent in certain local economic structures.

The positive influence of self-efficacy on intention indicates that individuals who are more confident in their ability to perform protective behaviors are more likely to intend to do so. This finding is consistent with the broader principle that when people recognize their vulnerability and understand the potential risks to their livelihoods and lives, their motivation to act increases. While self-efficacy contributed significantly to explaining farmers' intentions in this model, respondents' overall self-efficacy scores were relatively low. This is a critical point, as previous research

confirms a positive link between self-efficacy and protective behaviors (Lahiri et al., 2021). Given that many farmers are middle-aged and have limited health literacy, targeted interventions to raise awareness are essential (Sadri et al., 2022). Enhancing farmers' capacity also requires extension courses focused on precision farming, agricultural intensification, and diversification.

Perceived severity was the most influential construct on intention, followed by response efficacy. The pandemic's severe and widespread impact disrupted farmers' ability to work and earn a living. National and provincial lockdowns exacerbated this by restricting travel to urban markets and curtailing agricultural activities, leading to significant income loss. The finding that response efficacy positively influences preventive intention aligns with previous studies (Harris et al., 2020, Coluccia et al., 2021). The relatively high mean score for response efficacy (3.85) suggests that strategies like borrowing from social networks, accessing government loans, and using credit funds were perceived as effective for sustaining livelihoods. Consequently, ensuring access to soft loans and livelihood credit is critical for supporting rural households. To mitigate income loss, many farmers increased their reliance on local products, a trend also observed by (Lin et al., 2020). Conversely, as agricultural incomes declined, some attempted to migrate to cities for work, but travel restrictions often thwarted these efforts, deepening rural poverty.

Farmers perceived COVID-19 as highly costly in terms of response. This aligns with studies noting that the pandemic significantly increased expenses for medicine and treatment, further straining household resources (Lahiri et al., 2021). Overall, the pandemic exacerbated rural impoverishment by simultaneously increasing health-related costs and eroding economic resilience. Finally, the results confirm that both threat appraisal constructs—perceived severity and perceived vulnerability—significantly influence the intention to adopt preventive behaviors. The greater the perceived severity and vulnerability, the stronger the intention to prevent infection, a relationship well-established in prior research (Komendantova et al., 2022, Harris et al., 2020, Coluccia et al., 2021).

This study has several limitations. First, the cross-sectional design captures data at a single point in time, whereas the long-term effects on livelihoods are best assessed over time. Future longitudinal research would provide more robust evidence of these dynamic impacts. Second, while the sample was randomly selected, it primarily reflects male perspectives, with only 12.2% of respondents being women. This gender imbalance may introduce bias, as female farmers often face distinct

vulnerabilities during disasters. The gender-specific impacts of COVID-19 were not examined here; future studies should investigate these aspects to inform gender-sensitive livelihood programs.

Third, the findings rely on self-reported data from household heads present in the villages. As some heads had migrated for work during the pandemic, their experiences were not captured, potentially limiting the representativeness of the results. Future research should aim to include migrant farmers to better understand the pandemic's actual impact on rural livelihoods.

CONCLUSION

This study applied the Protection Motivation Theory (PMT) to model farmers' intentions to protect their livelihoods during the COVID-19 pandemic. The results confirm the influence of all PMT constructs on intention, providing new evidence for the theory's utility in predicting farmers' protective motivations. Given its explanatory power, PMT offers a valuable framework for designing interventions to promote preventive behaviors across diverse populations.

The significant relationship between intention and behavior confirms that intention acts as a precursor to action. Despite farmers reporting strong intentions to safeguard their livelihoods, their actual protective behaviors remained weak. This intention-behavior gap can likely be attributed to several factors: their first encounter with a pandemic, limited health literacy, and inadequate extension services to support income diversification.

The findings from the threat appraisal reveal that farmers perceived a high vulnerability to COVID-19, and they felt the pandemic had a substantial negative impact on their livelihoods. Similarly, the coping appraisal results indicate that COVID-19 was perceived as a severe and costly threat. While response efficacy (e.g., access to loans) was recognized as crucial for protection, farmers' self-efficacy in coping with the pandemic was low. Enhancing self-efficacy through targeted vocational and extension training is, therefore, essential.

These insights have direct implications for policymakers and practitioners. Health planners and extension services can use them to design targeted educational programs that improve health information dissemination and support informed decision-making during crises. Furthermore, empowering resource-poor farmers—particularly those in remote areas—requires a multi-faceted approach. Key interventions include developing rural infrastructure, expanding health education and insurance schemes, providing subsistence packages, and offering accessible low-interest loans.

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Authors Contribution

Asghar Bagheri: Conceptualization, Data curation, Project administration, Supervision, Validation, Writing-review & editing. Naier Emami: Formal analysis, Investigation, Methodology, Software, Writing-original draft,

Availability of data and materials

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

Conflict of interests

The authors declare that they have no competing of interest.

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