

# Health Behaviors of Livestock Industry Workers Regarding Crimean-Congo Hemorrhagic Fever in Northwest of Iran

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## Research article

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## Abstract

**Background:** Crimean-Congo hemorrhagic fever (CCHF) is an acute, febrile disease that is either caused by tick bites or the direct contact of humans with the blood and tissues of infected livestock. The majority of patients suffering from this disease are slaughterhouse workers (including butchers), farmers, veterinarians and hospital staff. Thus, this study aimed to investigate the health behaviors of butchers regarding CCHF and study factors affecting such behaviors based on the health belief model.

**Methods:** This is a descriptive cross-sectional study conducted on 500 butchers in Ardabil Province in 2020 by a multistage sampling method. The participants of the study completed the researcher-made questionnaire of health belief model and health behaviors model relevant to CCHF. The collected data were then analyzed by descriptive statistical tests and linear regression analysis.

**Results:** The mean (SD) age of the participants was 44.4 (10.5), and 96% were males. Only xxx% of the participants displayed acceptable disease-preventive behaviors. The validity and reliability of the developed questionnaire were confirmed by the Cronbach-alpha index. The results of the exploratory factor analysis showed that the constructs of the model explained 84% of the total variance. The results of the study revealed that among the variables of the health belief model, perceived susceptibility ( $p$ -value = 0.006,  $\beta$  = 0.152) and perceived barriers ( $p$ -value = 0.05,  $\beta$  = 0.14) were the strongest factors predicting disease-preventive behaviors regarding CCHF.

**Conclusion:** The results of the study showed that the health belief model can predict preventive behaviors for CCHF. Therefore, designing and executing interventions based on the results of this study may encourage such preventive behaviors in butchers.

## Background

Crimean-Congo hemorrhagic fever is an acute, febrile disease (Messina et al., 2015) caused by a tick-borne virus (Nairovirus) of the Bunyaviridae family (Duh et al., 2007). It is an arboviral disease that is transmissible from arthropods (Gozel et al., 2014) and is transferred from hard-bodied ticks from the genus *Hyalomma* to humans (Tahmasebi et al., 2010; Telmadarraiy et al., 2010). Crimean-Congo hemorrhagic fever was first diagnosed in the Crimean Peninsula, Ukraine, in 1944; a decade later, a similar disease with the same symptoms was reported in the Republic of the Congo in 1956, hence the name of the disease as Crimean-Congo hemorrhagic fever (Casals et al., 1969; Chinikar et al., 2010; Hoogstraal et al., 1979). The disease suddenly starts with a high fever as the main symptom. The initial symptoms of the disease are fever, severe muscular pain especially backache, weakness, anorexia, irritability, vomiting, stomachache and diarrhea. The disease then starts to progress with the following symptoms: leukopenia (a decrease in the number of white blood cells), leukocytosis (an increase in the number of white blood cells), thrombocytopenia (a decrease in the number of platelets), Mucosal bleeding, petechiae and ecchymosis (Gandhi et al., 2011; Ozer et al., 2010; Yilmaz et al., 2010).

One of the most frequent types of transmission for the disease is tick bites. It can also be transmitted to humans by direct contact with the blood and tissues of infected livestock, person-to-person contact with the excretory secretions of infected people or their belongings in hospitals. The majority of patients suffering from this disease are butchers, slaughterhouse workers, farmers, veterinarians and hospital staff (Chinikar et al., 2012). Sheep, cow and other domestic animals are the reservoirs of the virus which are either not infected themselves or if infected, they show no clear symptom, hence the difficulty of the diagnosis of the disease in animals. The geographical distribution of the disease depends on the distribution of the vector: hard-bodied tick *Hyalomma* (Abdollahi et al., 2015). This virus has been reported in more than 30 African, Eastern European, Middle Eastern and Asian countries (Ali et al., 2013) including Iran's neighboring countries such as Afghanistan, Pakistan, Iraq, Turkey, Arabian countries as well as Kazakhstan and Uzbekistan (Owaysee et al., 2008). According to a report by the World Health Organization in 2008 and the geographical dispersion map of the disease in 2015, Iran is located in the endemic belt for the disease (Ahmadkhani et al., 2018; WHO, 2008).

The highest incidence of the disease has been reported in spring and summer, especially in July due to the activity of the vector ticks, and the lowest incidence has been reported in autumn (Saghafipour et al., 2019). Based on standard health protocols, repulsive substances and safe acaricides are used (Asl et al., 2018; Vatandoost et al., 2012). Observing health regulations and exhibiting healthy behaviors result from proper education and awareness and can prevent Crimean-Congo hemorrhagic fever (Asl et al., 2018). The health belief model can help understand preventive behaviors better and be employed as an effective model in educational programs for occupational injuries (Tabatabaei et al., 2007). Based on this model, people display appropriate behaviors and reactions to health regulations and preventive measures only when they feel they are exposed to a real danger (perceived susceptibility) and this danger is seriously threatening them (perceived severity); thus, they start to believe that changing their behavior is beneficial (perceived benefits) and that they are able to remove barriers in their way of exhibiting correct health behaviors (perceived barriers). Self-efficacy means how a person judges and evaluates their own abilities to perform a task. Although a few studies have been carried out in Iran on health workers' awareness and performance regarding Crimean-Congo hemorrhagic fever (Cagdas et al., 2012; Salimi et al., 2016), no study has specifically focused on butchers' health beliefs and preventive behaviors in terms of Crimean-Congo hemorrhagic fever. Hence, given the importance of their behavior in preventing Crimean-

Congo infection, this study aimed to investigate butchers' preventive behaviors regarding Crimean-Congo hemorrhagic fever in Ardabil Province.

## Method

### Study design and setting

This is a descriptive-analytical cross-sectional study including all meat distribution centers in Ardabil Province, Iran, conducted based on a multistage sampling method. In the initial stage, each city in the province was regarded as a stratum; then in the second stage, each city was divided into four classes, and the required sample was collected from each class based on the convenience sampling method. A total of 500 butchers working in the livestock and meat distribution industry in Ardabil Province were interviewed concerning Crimean-Congo hemorrhagic fever. The instrument of the study was a standard questionnaire consisting of two sections. The first section comprised participants' demographic information, and the second section included 30 questions in six parts: perceived susceptibility construct (four items), perceived severity construct (five items), perceived benefits construct (five items), perceived barriers (five items), perceived self-efficacy (four items) and behavior construct (seven items). The reliability of the scale was assessed by Cronbach-alpha, and the validity of the scale was measured in terms of content and construct validities.

### Statistical analysis

Statistical analyses were performed with SPSS IBM-20 software. The significance level was set at  $p \leq 0.05$ . For descriptive statistics, mean  $\pm$  standard deviation (SD) and percentages were used. The Kolmogorov-Smirnov test was used to examine the normality of quantitative variables in the samples. One-way analysis of variance was employed for the comparison of continuous variables among groups (more than 2 categories), and students' tests were used for the comparison of quantitative variables between the two groups. Health behavior of CCHF patterns were derived using Principal Component Analysis (PCA) as a type of factor analysis procedure. Kaiser-Meyer-Olkin (KMOtest) and Bartlett's test of sphericity were used to assess the suitability of running PCA. The sampling adequacy and inter-correlation of factors were supported by KMO value  $> 0.8$  and Bartlett's test of sphericity  $< 0.001$ , respectively. Factors were retained based on an eigenvalue of  $> 1$  for the screen plot. Then, Varimax rotation was applied to review the correlations among variables and factors.

## Results

The mean (SD) age of the participants of the study was 44.4 (10.5). The participants' age ranged from 17 to 74 years old. Around 52% of the participants lived in cities, and 96% were males; 86.2% were above level 1 in terms of education, and 82.9% were married. The mean (SD) work experience among them was 14.5 years (9.9). The lowest work experience was one year and the highest was 57 years.

The result of the validity of the questionnaire was assessed in terms of content validity. The content validity of 15 items was 100%, five items 85% and 8 items 80%. The total validity of the questionnaire was 91.6%. The reliability of the questionnaire was measured based on the Cronbach-alpha index. The total reliability of the questionnaire was 92%: 98.6 for perceived susceptibility construct, 91.6% for perceived severity construct, 77.4% for perceived benefits construct, 88.2% for perceived barriers construct, 75% for perceived self-efficacy construct and 90.5% for behavior construct.

Table 1 shows the results of factor analysis showing the number of factors. The results of the KMO test equaled 0.889 proving that the number of samples for running factor analysis was adequate (KMO  $\geq 0.8$ ). The result of Bartlett's test of sphericity was also significant ( $p \leq 0.05$ ) showing that factor analysis was appropriate for detecting the construct and factorial model and that the coefficient matrix of variables in the population formed a unified matrix. In this table, only those factors were considered that the special value 1 or higher. As observed in Table 2, six factors were extracted from the questionnaire. The cumulative percentage equaled 83.7% meaning that the six factors explained 84% of the total variance.

Table 1  
Factor loading matrix of groups for health behaviors of CCHF in Ardabil province.

Group	1	2	3	4	5	6
Eigenvalue	4.38	3.05	1.83	1.45	1.07	1.03
Because I am cautious I do not infect to CCHF.	<b>.550</b>					
CCHF affects most inexperienced people and I am an exception.	<b>.367</b>					
While slaughtering livestock, as I do not wear glasses, I may be suffering from CCHF.	<b>.488</b>					
I do not use a mask when slaughtering livestock, so I may be suffering from CCHF.	<b>.498</b>					
In my opinion, CCHF is a fatal disease.		<b>.581</b>				
In my opinion, the CCHF causes only a slight fever and is not very serious.		<b>.542</b>				
In my opinion, CCHF causes long-term hospitalization.		<b>.312</b>				
In my opinion, the person with CCHF itself is recovered.		<b>.628</b>				
In my opinion, the CCHF costs a lot of money.		<b>.446</b>				
If I use a mask when slaughtering livestock, I will not get the CCHF.			<b>.612</b>			
If I use suitable glasses at the time of slaughter, I will not get the CCHF.			<b>.610</b>			
If I use gloves at slaughter, I will not get the CCHF.			<b>.557</b>			
If I use caution when contacting livestock or slaughtering, I will not get the CCHF.			<b>.421</b>			
If I am not infected with ticks during slaughter or slaughter, I will not get the CCHF			<b>.447</b>			
It is hard for me to use gloves when slaughtering livestock.				<b>.538</b>		
At the time of slaughter, I could not wear glasses.				<b>.464</b>		
At the time of slaughter, it is difficult for me to use a mask and cause shortness of breath.				<b>.600</b>		
When slaughtering livestock, the use of work clothes and boots is time consuming.				<b>.452</b>		
At the time of slaughter, there is no place to hold a knife and I have to take the knife with my teeth.				<b>.400</b>		
I can easily wear glasses during slaughter.					<b>.635</b>	
I can always use gloves to touch and slaughter the animal.					<b>.647</b>	
I can use a proper mask at the time of slaughter.					<b>.541</b>	
I can easily wear boots and work clothes before slaughter.					<b>.448</b>	
Did you have a history of contact with carcasses, blood or raw red meat?						<b>.605</b>
Do you always use gloves when slaughtering livestock or in contact with blood and carcasses?						<b>.500</b>
Do you always wear a mask when slaughtering animals or in contact with blood and carcasses?						<b>.557</b>
Do you always wear appropriate glasses when slaughtering livestock or in contact with blood and carcasses?						<b>.654</b>
Do you always use work clothes and boots when slaughtering livestock or in contact with blood and carcasses?						<b>.381</b>

\*Absolute factor loading values < 0.30 for the six patterns were excluded for simplicity

Group	1	2	3	4	5	6
Do you always carry a knife with your mouth when slaughtering animals or contacting blood and carcasses?						.375
Do you have a history of physical contact with ticks?						.529
Total variance	29.320%	20.001%	12.220%	9.659%	7.127%	5.077%
*Absolute factor loading values < 0.30 for the six patterns were excluded for simplicity						

Table 2  
Relationship between HBM constructs and health behaviors of CCHF with demographic variables in Ardabil province.

Variable	Mean (SD)	Living place		Marital		Education			
		Village	Urban	Single	Married	Illiterate	Under Associate Degree	Associate Degree	Above Associate Degree
Perceived susceptibility	9.4(2.5)	9.3(2.3)	9.4(2.5)	9.6(2.2)	9.3(2.5)	8.36(1.96)	8.89(2.37)	10.09(1.95)	10.92(2.24)
		0.683		0.366		0.001			
Perceived severity	12.1(1.6)	12(1.5)	12.2(1.7)	11.9(1.9)	12.51(1.4)	9.89(2.63)	11.35(1.81)	11.89(1.99)	13.21(2.02)
		0.173		.003		0.001			
Perceived benefits	10.6(2.9)	10.7(2.7)	10.5(2.9)	10.9(2.7)	10.5(2.8)	9.01(2.16)	9.94(2.75)	10.80(2.85)	11.71(3.11)
		0.383		0.339		0.001			
Perceived barriers	14(4.4)	14.2(5.4)	13.8(3.1)	14.3(2.7)	13.9((4.6)	9.50(2.80)	13.07(4.81)	14.05(3.11)	16.50(2.51)
		0.341		0.487		0.001			
Self-efficacy	8.7(3.2)	8.3(2.4)	9.2(3.8)	9.2(2.7)	8.6(3.3)	7.63(2.10)	8.58(2.76)	9.48(2.24)	12.30(2.68)
		0.006		0.160		0.001			
Behavior	11.1(1.2)	9.48(1.2)	11.2(1.2)	11.3(0.9)	11.1(1.3)	8.82(1.88)	9.46(1.19)	11.41(1.41)	13.69(1.60)
		0.008		0.113		0.001			
Total	66(5.9)	65.6(5.6)	66.3(6.2)	67.2(6.1)	65.7(5.9)	52.96(7.14)	61.31(6.63)	67.74(5.14)	77.35(7.19)
		0.210		.049		0.001			

The mean and SD of the constructs of the health belief model and preventive behaviors are depicted in Table 2. As seen in Table 3, there was a significant relationship between living location and self-efficacy and behavior as those butchers living in the city scored higher compared to those living in rural areas. The marital status was only significantly related to perceived severity because married butchers scored higher in this construct. Education level was significantly related to all constructs as an increase in the level of education increased the scores in all constructs. Similarly, the score of preventive behavior had a significant relationship with education level because an increase in education level raised the scores in preventive behaviors.

Table 3  
The relationship between health behaviors of CCHF and HBM constructs in Ardabil province.

variable	1	2	3	4	4	5
1.Perceived susceptibility	1					
2.Perceived severity	.024	1				
3.Perceived benefits	-.295**	.090	1			
4.Perceived barriers	-.050	-.014	-.174**	1		
5.Self-efficacy	-.051	.194**	.188**	-.517**	1	
6.Behavior	.122*	.113*	-.006	-.180**	.153**	-.122*

Table 3 depicts the correlations between the constructs of the health belief model and preventive behaviors regarding Crimean-Congo hemorrhagic fever. As observed in Table 4, all constructs except perceived benefits had a significant correlation with preventive behaviors.

The results revealed that of all variables of this model, perceived susceptibility and perceived barriers were the most important and strongest factors predicting behaviors that could prevent Crimean-Congo hemorrhagic fever (Table 4).

Table 4  
The results of the multiple linear regression analysis of the HBM constructs regarding health behaviors of CCHF in Ardabil province.

variable	B	Std. Error	Beta	P value
Perceived susceptibility	.082	.030	.152	.006
Perceived severity	.078	.042	.100	.062
Perceived benefits	-.032	.026	-.068	.223
Perceived barriers	-.060	.026	-.140	.023
Self-efficacy	.025	.023	.064	.295
Constant	11.841	.721	—	.000

## Discussion

Crimean-Congo hemorrhagic fever is one of the most frequent types of occupational diseases amongst veterinarians, butchers and slaughterhouse workers (Chinikar et al., 2010; Tabatabaei et al., 2007). This study investigated the preventive behaviors of and factors affecting such behaviors in 500 butchers working in butcheries and slaughterhouses in all rural and urban areas of Ardabil Province. Although few similar studies have been carried out in the west of Iran (Salimi et al., 2016) and Turkey (Cagdas et al., 2012), this study was the first on its kind that investigated the health beliefs and preventive behaviors of butchers regarding Crimean-Congo hemorrhagic fever in this region.

The findings of this study demonstrated that the preventive behaviors of butchers and livestock workers regarding Crimean-Congo hemorrhagic fever were not generally acceptable. Other studies have also reported that awareness and attitudes in this regard are less than 10% (Masoudy et al., 2016) and emphasized that such workers need periodical education. In another study in the west of Iran, it was found that the amount of awareness and performance of slaughterhouse workers and veterinarians significantly raised after educational courses (Abdollahi et al., 2015).

Moreover, corresponding with the findings of previous research, it was found that preventive behaviors had significant correlations with perceived susceptibility construct and perceived barriers construct. For instance, Jiang observed that perceived threat regarding SARS preventive behaviors was the strongest predictor of behavior (Barati et al., 2020). Also, Barati et al. found a significant, positive correlation between behavioral intention and perceived threat (Jiang et al., 2009).

According to the results of this study, the living location was the only variable among demographic ones that had a significant relationship with perceived self-efficacy and preventive behaviors. The marital status of the participants was only significantly correlated with perceived severity. The most important factor related to health behavior constructs and preventive behaviors was the educational level of the butchers that had significant correlations with all constructs ( $p \leq 0.05$ ). In line with the findings of the current study, previous literature has revealed that education and literacy significantly affect awareness, performance, attitude and behavior (Taghdisi et al., 2012; Yolcu et al., 2014).

## Conclusion

According to the results of the study, perceived susceptibility and perceived barriers were the strongest factors predicting the exhibition of preventive behaviors regarding Crimean-Congo hemorrhagic fever. Thus, designing and executing appropriate interventions based on the findings of this study can encourage such behaviors in slaughterhouse butchers and workers.

## Abbreviations

CCHF: Crimean-Congo hemorrhagic fever, SD: standard deviation, PCA: Principal Component Analysis

## Declarations

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## Ethics approval and consent to participate

This study was reviewed and approved by the Ethical Committee of Ardabil University of Medical Sciences, Iran (Code of ethics: IR. ARUMS. REC.1397.066). In addition, the informed consent, written, was obtained from all participants.

## Authors' contribution

EMA and MA have designed the research methods and study structure. AS, JA, ABP and DA arranged a walk through study, and collected data. ZT and MA analyzed data and interpreted the results. First manuscript was written mainly by EM, MA, and AS. Manuscript has been reviewed by DA, and ZT decided to submit the article. All the authors read and approved the final manuscript.

## Competing Interests

All authors have no conflicts of interest to declare.

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