Predictive Factors Related To Brucellosis Prevention Among Livestock Farmers Based on The PRECEDE-PROCEED Model

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Abstract

Brucellosis is one of the most common zoonotic diseases that wreaking havoc on economy of rural communities and society in general. In this study we sought to determine the predictive factors related to brucellosis prevention among livestock farmers in rural areas of Germi county. In a cross-sectional analytical study, 365 Livestock farmers in villages of Germi were selected using cluster sampling. Educational needs assessment about brucellosis were assessed using the questionnaire comprising 4 modules; first module included demographic characteristics and other 3 modules assessed the components of PRECEDE-PROCEED Model (i.e., predisposing factors, enabling factors, and Reinforcement factors). A high average ($M = 64.5 \pm 6$) knowledge about the transmission of brucellosis was observed among livestock farmers. However, the mean of attitude scores (about the regular visit of animals by the veterinarian and the effects of the disease on health status) were low ($M = 27 \pm 3.3$). Enabling factors (having protective equipment, access to pasteurized dairy products, keeping livestock outside the village and vaccination of livestock) had the low average ($M = 35 \pm 8.7$). Enabling factors and reinforcement factors were strongly correlated ($r = 0.338, p = 0.001$). This study indicated that increasing of enabling factors can lead to livestock empowerment and brucellosis prevention among them in rural areas of Germi county.

Introduction

Brucellosis (malta fever or Mediterranean fever)) is one of the zoonotic diseases (common between human and animals) that endangers the health of the population, particularly in developing countries. (1, 2). Brucellosis is caused by intracellular, gram-negative cocco-bacilli bacterium. that is transmitted through direct human contact with livestock, drinking or eating unpasteurized, contaminated milk or cheese and uncooked meat consumption. (3–5)

The occurrence of brucellosis in developed countries have been decreased through livestock vaccination (6). Meanwhile, in developing countries, the risk of infection still remains high. Brucellosis has a relatively long socio-economic effects on the livestock industry due to its physical effects. (7)

According to World Health Organization (WHO), approximately half a million cases of brucellosis are diagnosed around the world annually (8). Iran—-a developing country—20 in 100,000 people are diagnosed by brucellosis annually (9). Ardabil province and Garmi county villages are one of the areas where livestock farming is most common (10). For example, evidence shows that about 2–33 out of every 100000 people are affected by brucellosis in Ardabil province (10–12).

The common symptoms of Brucellosis include fever, night sweats, migratory arthralgia and myalgia, loss of appetite, decreased white and red blood cell counts, and increased liver enzymes (13, 14). The concentration of brucellosis bacteria that usually occur in bones and joints and cause spondylitis and osteomyelitis of the lumbar spine is a symptomatic characteristic of this disease (15). Lumbar lesions on radiological assessing can lead to misdiagnosis by a physician if the examining physician is not familiar
with the geographical area of the patients and how diseases characteristics differ in that region. This might be mistaken for lumbar disc lesions in the clinical imaging process. Therefore, better understanding endemic characteristics of brucellosis and how it affects the especial residential region is pivotal to early diagnosis and on time treatment, which in turn can save lives. \((16, 17)\)

The most important process in a health system for disease prevention is to conduct a needs assessment based on the population health needs. \((18)\) The recent success of the health system in preventing brucellosis in developed countries is mostly due to health needs assessments \((19)\). The main focus of health education is to improve the behavior of individuals, groups and communities.

Using health education models can play an important role in both identifying basic health needs and successful planning for behavior change. The Precede model can be effective in identifying and meeting educational needs \((20, 21)\). The PRECEDE-PROCEED Model is an extensive structure for assessing health needs for designing, implementing, and evaluating health promotion and other public health programs to encounter those needs. This model has 8 phase including Social Diagnosis - Epidemiological, Behavioral, and Environmental Diagnosis – Educational and Ecological Diagnosis – Administrative and Policy Diagnosis – Implementation of the Program – Process Evaluation – Impact Evaluation – Outcome Evaluation. An educational diagnosis of the problem is very essential before designing and implementing the intervention plan. Hence, the third phase of model, which is the educational stage, is discussed. Three basic constructs of educational needs assessment phase including predisposing factors (i.e., knowledge, attitude and self-efficacy) and enabling factors (i.e. Livestock maintenance conditions and facilities and skills) and reinforcement factors (i.e. helping relationship, regular veterinary visit) \((21)\). Predisposing factors prepare individuals for healthy behavior, enabling factors includes the facilities and conditions that create the ground for behavior change, and the reinforcement factors includes the helping relationships that help the person to do the behavior \((22, 23)\).

Germi is one of the cities of Ardabil province that has many villages in its four regions including Moran, Ongut, Zahra and Central region. The main occupation of many residents of these villages is agriculture and livestock farming. In many villages livestock production and consumption provides a major source of income. Taken together, the use of this model in order to better understand the needs assessment concerning TB disease among workers (e.g., livestock farmers) in this area is crucial and can help the health system in eliminating brucellosis in the future. Hence, in this study using the only PRECEDE model, we examined the predictive factors related to brucellosis prevention among livestock farmers in rural areas of Germi county. We hypothesized that predisposing factors such as knowledge, attitude and self-efficacy could play an effective role in empowering Livestock farmers to prevent incidence and transmission of brucellosis.

**Material And Methods**

**Study design**
In a cross-sectional analytical study, 365 Livestock farmers in rural areas of Germi county were included in the study by cluster sampling. In this study, we selected the Germi county due to the annual incidence of 60 to 70 cases of brucellosis was selected.(10). The statistical population in these study was 7177 person consisting of 7140 traditional Livestock farmers, 22 industrial livestock workers, 12 person from cheese factories, 3 slaughterhouse workers, who were directly related to livestock or their products. Based on the Cochran's formula and considering the default values for P and Q (P=0.5 , Q=0.5) and d=0.05, the sample size for the present study was estimated to be 365. Germi county was divided into four clusters including Moran, Ongut, Zahra and Central cluster From each of the four clusters, 90 traditional Livestock farmers and 3 to 5 industrial livestock workers or workers related to livestock products were selected. Inclusion criteria included 1- having livestock 2- living in the village and 3- completing informed satisfaction. In the absence of any of these conditions, the samples would be excluded from the study.

Instrument

The standard questionnaire of PRECEDE-PROCEED Model was used which consisted of four parts, i) demographic section with 10 questions, ii) predisposing factors with 42 questions including awareness (27 questions), attitude (15 questions) with triple Likert option (right, wrong, do not know) and iii) enabling factors with 16 questions including 5 items of conditions and facilities with triple Likert (Agree, Disagree, Have no opinion) and 11 skill items with five Likerts (Always, Often, Sometimes, Rarely, Never) and ) reinforcement factors with 9 questions with triple Likert (Agree, Disagree, Have no opinion). Content validity index (CVI) of the questionnaire was confirmed by a panel of experts consisting of 2 epidemiologists, 2 infectious disease specialist and 6 health education specialists.(CVI= up to 0.92) The reliability of the questionnaire was confirmed by test-retest on 40 Livestock farmers (who were not included in the main analysis) as a pilot study with Cronbach's alpha coefficient of 0.82.

Data analysis

First, the mean scores of predisposing, enabling and reinforcing factors were analyzed using descriptive statistics. Then the relationship between these structures was investigated through Pearson correlation and ultimately using of ANOVA and regression, effects of enabling factors on reinforcement factors had been analysed. Data were analyzed using SPSS v.20 and p<0.05 was considered statistically significant.

Results

In this study, participants had a mean (SD) age of 42.5 ± 12.5, 49.3% (n = 180) were men, 34.2% of participants were illiterate, 57.3% with less than diploma and 8.5% had diploma. Major occupations in women was housewife (49.3%), and in men were farmer (32.9).

Our findings showed that predisposing factors had the highest mean (M = 102.5 ± 7.7) in assessing the needs of Livestock farmers in the prevention of brucellosis. Enabling factors (M = 45.1 ± 8.7) and reinforcement factors (M = 17 ± 5.7) were in the next stages, respectively. (see Table 1)
Table 1
Descriptive analysis of PRECEDE Model constructs in the prevention of brucellosis among Livestock farmers

|                             | N  | M     | SD  |
|-----------------------------|----|-------|-----|
| Reinforcement factor (Helping relationship and healthy behavior doing) | 365| 17.53 | 5.49|
| Enabling factor (eg skills and facilities)                          | 365| 45.11 | 8.70|
| Predisposing factor (eg knowledge, attitude)                       | 365| 102.55| 7.7 |
| Knowledge                                                           | 645| 6     |     |
| Attitude                                                            | 27 | 3.3   |     |

The results of Pearson correlation showed that enabling factors includes conditions for keeping livestock outside the village and access to livestock vaccinations and proper use of pasteurized dairy products and healthy meats has strong relationship with reinforcement factors (helping relationships that help the Livestock farmers to engage in healthy behavior). While predisposing factors did not correlated significantly with enabling factors and Reinforcement factors. (see Table 2)

Table 2
Correlation of PRECEDE constructs in the prevention of brucellosis

|                             | Reinforcement (Pearson Correlation) | Predisposing (Pearson Correlation) | Enabling (Pearson Correlation) |
|-----------------------------|------------------------------------|------------------------------------|--------------------------------|
| Reinforcement               | 1                                  | 0.101                              | 0.338**                        |
| Sig. (2-tailed)             | -                                  | 0.054                              | 0.001                          |
| N                           | 365                                | 365                                | 365                            |
| predisposing                | 0.101                              | 1                                  | 0.065                          |
| Sig. (2-tailed)             | 0.054                              | -                                  | 0.218                          |
| N                           | 365                                | 365                                | 365                            |
| Enabling                    | 0.338**                            | 0.065                              | 1                              |
| Sig. (2-tailed)             | 0.001                              | 0.218                              | -                              |
| N                           | 365                                | 365                                | 365                            |

**. Correlation is significant at the 0.01 level (2-tailed).

We found that enabling factors among Livestock farmers had a great impact on reinforcement factors to protect them against brucellosis.(see Fig. 1), while predisposing factors alone had not such an effect.

When we assessed the mediating effects of enabling factors on the relationship of predisposing factors and reinforcement factors through linear regression, this relationship also became significant.(see
Table 3)

Table 3
Mediating effects of enabling factors on relationship of predisposing factors and reinforcement factors

| Precede constructs prediction | R    | R²   | A.R²  | Sig |
|------------------------------|------|------|-------|-----|
| Enabling factor, predisposing | 0.347| 0.120| 0.115 | 0.001|
| Only Enabling factors        | 0.338| 0.114| 0.112 | 0.001|
| Only predisposing factors    | 0.101| 0.010| 0.007 | 0.054|
| Dependant variable: Reinforcement factors | |

Discussion

Brucellosis is one of the most common infectious diseases transmitted from livestock which has negative socio-economic effects on the life of the rural population. Given that most of the villagers are engaged in livestock occupation, the occurrence of the Brucellosis should be prevented to reduce the burden of disease. This study showed that predisposing factors had the highest mean in assessing the needs of Livestock farmers in the prevention of brucellosis, followed by enabling factors and Reinforcement re-inforcement factors.

We found that predisposing factors such as knowledge, attitude had a higher mean than other constructs such as enabling factors and reinforcement factors. Although predisposing factors had a high average because of knowledge scores, but attitude items had a low average. The second item of knowledge, which was "Brucellosis is a zoonotic disease transmitted from livestock to humans," had a higher mean. Indeed the item 35 of attitudes construct includes "I think livestock needs to be examined by veterinarians" had a low score and item 39 "I don't think yogurt can transmit the disease" and item 40 attitudes "Keep livestock away from family members" had the lowest average. Therefore, in the needs assessment conducted People do not need to increase knowledge but needs to alter their attitudes in the field of brucellosis prevention. This results were in consistent with the study of Hajari et al. In Isfahan (24).

Despite having the high mean, predisposing factors did not show a correlation with enabling factors and reinforcement factors. Thus merely having knowledge about brucellosis can not empower the study population to prevent the brucellosis. The subjects had more information about the transmission of brucellosis through contaminated milk and did not know other ways of transmitting the disease, including consumption of dairy and meat products. They were also unaware of the respiratory transmission of brucellosis. Farmers' attitudes about regular veterinary visits and keeping livestock in a suitable place away from where family members live, should also be corrected. Although similar results were obtained in the study of Li et al (14), there was still a need to increase information about the transmission of disease through animal waste (24, 25).
Enabling factors such as providing facilities and conditions were strongly correlated with reinforcement factors. Items 53 to 58 had the highest correlation with reinforcement factor which were: "If I have livestock, I vaccinate them on time", "I will inform the veterinarian if a livestock abortion occurs", "I use gloves when milking livestock", "I use gloves to chop the livestock meat", "I put the meat in the refrigerator for 24 hours before chopping", "I do not use traditional ice cream" respectively. Therefore, when the mediating effects of enabling factors on the relationship between predisposing factors and reinforcement factors were investigated, it was observed that predisposing factors had a significant relationship with reinforcement factors. This results are consistent with previous reports (26, 27). This study has some limitations. First, we were unable to assess the cause-effects due to the cross-sectional nature of our study. Second, this study was done in a single region and might not be generalizable to other parts of Iran despite the fact that the prevalence of brucellosis in Germy is higher than national average (9, 10).

**Conclusion**

Despite these limitations, our study showed that predisposing factors are not merely effective in performing brucellosis prevention behaviors among Livestock farmers in Germi county. Therefore, to perform healthy behavior for brucellosis prevention, along with predisposing factors, enabling factors including facilities (ie development of livestock vaccination services and increase the access of Livestock farmers to these services) and conditions (i.e., creating suitable conditions for the keeping livestock outside the village and also creating purchasing facilities, collecting and transferring milk produced to pasteurized milk factories and finally increasing the performance of people in the use of gloves and masks when they are in contact with livestock and livestock products) must be available.

**Declarations**

**Ethical approval**: Informed consent was obtained from all participants. Ethic approval was obtained from Ethic Committee of Ardabil University of medical sciences (IR.ARUMS.REC.1399.202).

**Consent for publication**: All authors have agreed on the content of the manuscript.

**Conflict of interest**: None declared

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**Authors’ contributions**: study concept and data analyzing: Narimani S, manuscript writing: zarehoseinzade E and Maleki A and Kalan E, manuscript editing: Narimani S and Kalan E, Review of literature: Ahmadi F, Shaker H, Narimani S, Maleki A. All authors have read and approved the final version of the manuscript.

**Data Availability**: Publicly available.
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**Figures**
Figure 1

Effects of Enabling factors on reinforcement factors to protect against brucellosis