

Preplanned Studies

Brucellosis Knowledge and Personal Protective Equipment Usage Among High-Risk Populations in Brucellosis-Endemic Areas — China, 2019–2020

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Summary

What is already known about this topic?

According to the National Brucellosis Prevention and Control Plan (2016–2020) (NBPCP), the awareness rate of high-risk populations in brucellosis-endemic areas should reach 90% by 2020. But the updated results have not been reported.

What is added by this report?

This report determined the awareness rate of brucellosis (17.74%), utilization of personal protective equipment (PPE) (20.13%), and their relationship with seroprevalence, which provides evidence for the effectiveness of the implementation of NBPCP.

What are the implications for public health practice?

The results suggest that health education should be conducted for high-risk populations to improve their brucellosis and protection knowledge.

Brucellosis remains an important public health problem in most low-income and middle-income countries (1–3). During the past decade, the incidence rate and the number of reported cases of brucellosis have dramatically increased in China (4). To control brucellosis effectively, the National Brucellosis Prevention and Control Plan (2016–2020) (NBPCP) was formulated by the Ministry of Agriculture of China and the National Health Commission. Based on NBPCP, the awareness rate of high-risk populations in brucellosis-endemic areas should reach 90% by 2020 (5). This study was designed and conducted to determine the populations at high risk for brucellosis in endemic areas to provide the evidence to evaluate the effects of the NBPCP. From 2019 to 2020, China CDC established a cross-sectional study with an interviewed-based survey in Shanxi Province and Xinjiang Uygur Autonomous Region, that with high

incidences of brucellosis in China. Yanggao, Zuoyun, and Hunyuan counties in Shanxi Province and Huocheng county in Xinjiang Uygur Autonomous Region were selected. The local CDCs conducted face-to-face interviews. The results showed that the awareness rate and the utilization rate of personal protective equipment (PPE) in high-risk populations were relatively lower than the goals of the NBPCP. It is necessary to carry out targeted health education for high-risk groups.

The study subjects, sample size estimation, and seropositivity definition were described elsewhere (6). Using a questionnaire, data on population knowledge of brucellosis and PPE utilization was collected. Brucellosis knowledge primarily included transmission routes, symptoms, and domestic animal hosts, etc. The variable “Awareness” was scored as “yes” if respondents answered all five questions correctly and “no” if any questions were answered incorrectly. The utilization of PPE primarily included gloves, masks, rubber boots, and overalls, and the variable “Protection” was defined as a respondent who answered “often” or “occasionally” in all four aspects. Statistical analysis were conducted in R software (version 4.0.2, R Foundation for Statistical Computing, Austria) and χ^2 test with a significance level of $\alpha=0.05$ to test the difference in the proportion.

A total of 2,411 participants from 4 counties responded, and 2,384 of them met the requirements with a response rate of 98.88% (2,384/2,411). The crude awareness rate (i.e. “having awareness”) and utilization rate of PPE of brucellosis were 17.74% (423/2,384) and 20.13% (480/2,384), respectively. Figure 1 shows the awareness rate of brucellosis knowledge and utilization rate of PPE in different counties. The awareness rate of brucellosis knowledge and utilization rate of PPE in Huocheng County were the highest among the four counties. Table 1 demonstrated the correlation between the awareness

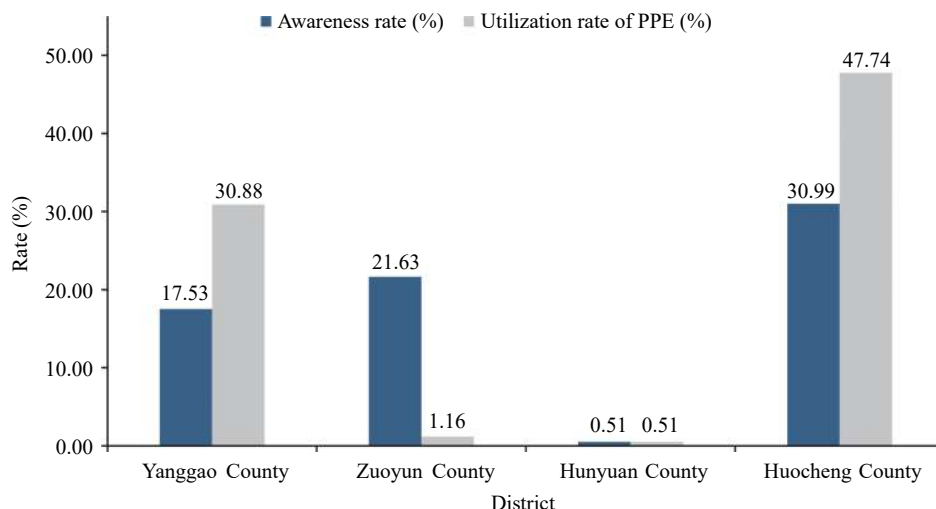


FIGURE 1. The awareness rate of brucellosis knowledge and utilization rate of personal protective equipment (PPE) among high-risk populations in four counties, 2019–2020.

rate of brucellosis knowledge in different aspects and seroprevalence. The proportion of respondents who heard of brucellosis was 96.81%, including those who knew of transmission (50.08%), prevention (69.55%), and symptoms (51.76%). However, only 31.88% of respondents knew about the species of domestic animal hosts that spread brucellosis. Although seroprevalence in the group that had awareness was lower than that in the group did not have awareness, no significant difference was found between them ($P=0.312$, >0.05)

except “Can brucellosis be prevented?” ($P=0.023$, <0.05). Table 2 illustrated the association between the utilization rate of PPE in different ways and seroprevalence. About a third of the respondents utilized PPE, including gloves (38.26%), facemasks (31.80%), boots (32.01%), and overalls (30.87%), respectively. The seroprevalence of the protected population was lower than that in the unprotected population. However, the difference was not statistically significant ($P=0.264$, >0.05).

TABLE 1. The awareness of brucellosis knowledge and the relationship between their seroprevalence among high-risk populations in Shanxi and Xinjiang from 2019 to 2020.

Questions	Having awareness	Infected	Uninfected	Total	Awareness rate (%)	Seroprevalence (%)	P-value
All		62	2,322	2,384		2.60	
Have you heard of brucellosis?	Yes	60	2,248	2,308	96.81	2.60	1.000 [¶]
	No	2	74	76		2.63	
What behaviors may cause a person to contract brucellosis? *†	Yes	29	1,165	1,194	50.08	2.43	0.597
	No	33	1,157	1,190		2.77	
Can brucellosis be prevented? *	Yes	35	1,623	1,658	69.55	2.11	0.023 ^{**}
	No	27	699	726		3.72	
What are the symptoms of brucellosis? *†	Yes	27	1,207	1,234	51.76	2.19	0.190
	No	35	1,115	1,150		3.04	
Which domestic animals can transmit brucellosis? *†	Yes	13	747	760	31.88	1.71	0.062
	No	49	1,575	1,624		3.02	
Awareness [§]	Yes	8	415	423	17.74	1.89	0.312
	No	54	1,907	1,961		2.75	

* The response was depended on those who answered “yes” for the first question.

† These were multiple-choice questions. The “yes” means who answered more than 70% of the questions correctly.

§ The “yes” means who answered all five questions correctly.

¶ Results from Fisher’s exact test.

** The seroprevalence difference was statistically significant ($P<0.05$).

TABLE 2. The utilization of PPE and the relationship between their seroprevalence among high-risk populations in Shanxi and Xinjiang from 2019 to 2020.

Questions	Utilization	Infected	Uninfected	Total	Utilization Rate (%)	Seroprevalence (%)	P-value
All		62	2,322	2,384		2.60	
Do you wear gloves when you work? *	Yes	17	895	912	38.26	1.86	0.075
	No	45	1,427	1,472		3.06	
Do you wear a facemask when you work? *	Yes	17	741	758	31.80	2.24	0.453
	No	45	1,581	1,626		2.77	
Do you wear boots when you work? *	Yes	14	749	763	32.01	1.83	0.107
	No	48	1,573	1,621		2.96	
Do you wear overalls when you work? *	Yes	13	723	736	30.87	1.77	0.087
	No	49	1,599	1,648		2.97	
Protection †	Yes	9	471	480	20.13	1.88	0.264
	No	53	1,851	1,904		2.78	

* The “yes” means who answered “often” or “occasionally”.

† The “yes” means who answered “often” or “occasionally” in all four aspects.

DISCUSSION

Since the 1990s, the incidence of brucellosis has been increasing and reaching a peak in 2014 and ranked among the top 10 Class A and Class B infectious diseases from 2008 to 2018 (4). The research group conducted a cross-sectional study in four counties in two provincial-level administrative divisions (PLADs) to acquire the awareness rate of brucellosis knowledge and utilization rate of PPE. This study showed evidence that awareness of brucellosis and utilization of PPE was insufficient. Since people who answered all awareness questions correctly were regarded as aware, the crude awareness rate of brucellosis knowledge was significantly lower than that of other studies (7). Most of the high-risk populations had heard of brucellosis. Nevertheless, most people did not know the animal hosts of brucellosis. The utilization of PPE was low with only about one-third of people in protection. Improving awareness of brucellosis knowledge and utilization of PPE are still vital to reduce the infection rate of brucellosis, but the methods may need to be improved through further research onto changing behaviors. According to other research, education level and household income were negatively correlated with brucellosis awareness, and elderly populations had lower brucellosis awareness than younger populations (8–9). Health education that focuses on high-risk and historically high prevalence PLADs need to be strengthened. The utilization of PPE needs to be further promoted. Different districts should communicate and exchange practical prevention and control experiences.

This study was subject to some limitations. First, there was a possibility of recall bias because of the retrospective nature of the questionnaire survey method. Second, due to the influence of COVID-19, China CDC only conducted project training but did not carry out field quality control. The quality of the questionnaires was limited by the inability of the team to hand-check every survey while in the field.

In summary, the results indicated that the awareness rate of brucellosis knowledge and the utilization rate of PPE were low in brucellosis-endemic areas in China. The goals set in the NBPCP are still far from being achieved. More effective health education should be carried out for high-risk populations to improve their knowledge of brucellosis and protection to reduce their risk of infection.

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Written informed consent has been obtained from the patients in accordance with the Declaration of Helsinki. The research group confirmed that the identification information of all participants (including patient names, ID numbers, home addresses and telephone numbers) would not be included in recordings, written descriptions or publications.

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REFERENCES

1. Franco MP, Mulder M, Gilman RH, Smits HL. Human brucellosis. *Lancet Infect Dis* 2007;7(12):775 – 86. [http://dx.doi.org/10.1016/S1473-3099\(07\)70286-4](http://dx.doi.org/10.1016/S1473-3099(07)70286-4).
2. Rubach MP, Halliday JEB, Cleaveland S, Crump JA. Brucellosis in low-income and middle-income countries. *Curr Opin Infect Dis* 2013; 26(5):404 – 12. <http://dx.doi.org/10.1097/QCO.0b013e3283638104>.
3. Pappas G, Papadimitriou P, Akritidis N, Christou L, Tsianos EV. The new global map of human brucellosis. *Lancet Infect Dis* 2006;6(2):91 – 9. [http://dx.doi.org/10.1016/S1473-3099\(06\)70382-6](http://dx.doi.org/10.1016/S1473-3099(06)70382-6).
4. Lai SJ, Zhou H, Xiong WY, Gilbert M, Huang ZJ, Yu JX, et al. Changing epidemiology of human brucellosis, China, 1955–2014. *Emerg Infect Dis* 2017;23(2):184 – 94. <http://dx.doi.org/10.3201/eid2302.151710>.
5. Ministry of Agriculture and Rural Affairs of the People's Republic of China and National Health Commission of the People's Republic of China and National brucellosis prevention and control plan (2016–2020). http://www.moa.gov.cn/govpublic/SYJ/201609/t20160909_5270524.htm. [2021-1-10]. (In Chinese).
6. Lin SH, Wang Z, Liu XR, Yu AZ, Hasan M, Bayidawulieti J, et al. Serological prevalence survey among the high-risk population of brucellosis-endemic areas — China, 2019–2020, China. *China CDC Wkly* 2021;3(6):101 – 5. <http://dx.doi.org/10.46234/ccdcw2021.027>.
7. Zhang N, Zhou H, Huang DS, Guan P. Brucellosis awareness and knowledge in communities worldwide: a systematic review and meta-analysis of 79 observational studies. *PLoS Negl Trop Dis* 2019;13(5):e0007366. <http://dx.doi.org/10.1371/journal.pntd.0007366>.
8. Zeng JY, Ciren DJ, Yundan DZ, Pu Q, Gongjue CW, Jiumei DJ, et al. A study of the knowledge, attitudes and practices of Tibetan yak herders with respect to brucellosis. *Int Health* 2018;10(4):294 – 301. <http://dx.doi.org/10.1093/inthealth/ihx076>.
9. Awah-Ndukum J, Mouiche MMM, Kouonmo-Ngnoyom L, Bayang HN, Manchang TK, Poueme RSN, et al. Seroprevalence and risk factors of brucellosis among slaughtered indigenous cattle, abattoir personnel and pregnant women in Ngaoundéré, Cameroon. *BMC Infect Dis* 2018;18(1):611. <http://dx.doi.org/10.1186/s12879-018-3522-x>.