Investigation on residents' cognition of HFRS and related knowledge in Jining city of Shandong Province, Mainland China

Miao-Miao Liu (✉ miao1206@126.com)

Jining Medical University

Wen-Jun Wang

Jining Medical University

Wen Liu

Zaozhuang Center for Disease Control and Prevention

Li-Yan Guo

Jining Medical University

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Abstract

Background: Hemorrhagic fever with renal syndrome (HFRS) is a serious public health problem caused by Hantavirus. China is the most severe endemic country in the world, accounting for about 90% cases. However, there are relatively few studies on residents' cognition of HFRS in the epidemic areas.

Methods: 960 residents were selected from four districts of Jining city, Shandong province in 2020. Information on cognition of HFRS and related knowledge was obtained using a questionnaire. Chi-square test was used to compare the differences of the cognition rate between demographic characteristics. The stepwise logistic regression analysis was used to determine the association between personal variables and cognition.

Results: The data from 892 qualified questionnaires were analyzed. The result showed that the cognition rate of HFRS among residents in Jining is 50.00%. The cognition rate of the source of HFRS infection among residents is 42.60%. And the cognition rate of HFRS vaccine is only 17.71%. Further regression analysis result showed that the main factors affecting residents' cognition of HFRS and related knowledge were age and education. Residents' awareness of infectious source affected their behavior. The results showed that 18.95% of the residents who knew the infectious source took protective measures when sweeping the barns, while among the residents who did not know the infectious source, only 10.16% of them took protective measures.

Conclusions: Residents' cognition of HFRS and related knowledge were affected by education. Residents' behavior would be affected by their cognition status.

Introduction

Hemorrhagic fever with renal syndrome (HFRS) is a global acute infectious disease caused by Hantavirus (HVs) in the Bunyaviridae family. The virus is transmitted mainly by rodent animals through urine, feces, and saliva and the aerosols produced by them.¹ Clinical characteristics of HFRS include fever, hemorrhage, kidney damage, or even multiple organ dysfunctions. HFRS remains endemic in Asia and Europe, while increased incidence rate have been reported in China.^{2,3} The case fatality rate of HFRS reported in mainland China ranges from 1.13% to 1.31%.^{3,4} Currently, there is no effective treatment available for HFRS. Despite HFRS bivalent inactivated vaccine and HFRS purified vaccine (Type I) are licensed for use in China, the protective efficacies of these vaccines are uncertain.⁵ Data from the National Notifiable Disease Surveillance System (NNDSS) shows that Shandong Province is one of the five provinces in China that has the highest incidence of HFRS.^{6,7} The Chinese government attaches great importance to anti-HFRS programs, including rodent surveillance and control, public health education, environment management, and especially the free vaccination project in endemic areas.⁸ It is necessary to understand the disease cognition and behavior of residents in high epidemic areas of HFRS. In this paper, we analyzed the data of residents' cognition on HFRS and the vaccine. Furthermore, we investigated the behaviors of residents lived in the high-endemic area. It would provide references for developing targeted strategies and measures on prevention of HFRS.

Methods

Ethics approval and consent to participate

Ethics Committee of Jining Medical University approved the investigation. The investigators ensured that each respondent fully understood the content of the study and volunteered to complete the survey.

Site Selection and Subject Recruitment

This investigation was based on an epidemiologic study in Jining City, Shandong province. Jining is located in the southwest of Shandong Province and includes 11 districts. Four districts were selected, including Jinxiang, Jiaxiang, Qufu, and Sishui. Three villages were randomly selected from each selected district, and 80 residents were investigated in each village. The survey was conducted with the informed consent of the participants.

Questionnaire survey

Cross-sectional information on disease cognition, knowledge of prevention vaccination, residential condition, and lifestyle was obtained through a questionnaire survey performed in 2020. All questionnaire responses were recorded electronically in a database according to a standardized code and file structure.

Statistical analysis

Statistical analysis was performed using IBM SPSS 22.0. Qualitative data were described by frequency. Chi-square test was used to compare the differences of the cognition rate between demographic characteristics. The stepwise logistic regression analysis was used to determine the association between personal variables and cognition. The results were considered to be significant at $p < 0.05$.

Results

Characteristics of the Participants

Of the 960 eligible participants, 892 returned the questionnaire (92.92%). The average age of the respondents was 56.37 and 524 of them were male. Participation rates varied across districts from 90.83 to 95.83%, but there was no significant difference. There were no significant differences in demographic characteristics, such as gender, profession, education and household income among different districts (Table 1).

The awareness rate of HFRS in the four districts was 52.29%, 49.31%, 51.11% and 47.39%, respectively, and there was no statistical difference ($\chi^2 = 1.24$, $p = 0.74$). The awareness rate of infectious source in the four districts was 39.91%, 42.01%, 43.11% and 43.48%, respectively, and there was no statistical difference ($\chi^2 = 0.19$, $p = 0.98$). In addition, there was slight difference on the cognitive status of HFRS vaccine among the four districts, but the difference was not statistically significant (Table 2).

Univariate analysis of cognitive status

The awareness rate of HFRS of the investigated residents was 50.00%. The residents who have these characteristics, such as male, migrant worker, younger age, higher education and higher income had higher awareness rate of HFRS. The awareness rate of infectious source was 42.60% which is lower than the cognition of HFRS. It was found that characteristics such as gender, profession, education level and age would have an impact on the awareness rate of infectious source of the residents. The residents' awareness rate of HFRS vaccine was 17.71%. The residents with the characteristics, such as younger age and higher education had higher awareness rate of HFRS vaccine (Table 3).

Multivariate analysis of cognitive status

Table 4 presents multivariate relationship between the cognition and potentially relevant personal characteristics. As shown in table 4, age is a risk factor for the cognition of HFRS. Factors like education and family income were found to be associated with the cognition of HFRS. There was a similar pattern for cognition of infectious source, and female's awareness of infectious source was lower than the male. Education was the only factor associated with the cognition of vaccine. Compared to the residents with primary education, the residents who had higher education had higher cognition for vaccine (OR=0.69, 95%CI, 0.56-0.84).

The influence of infectious source cognition on residents' behavior

We analyzed whether residents' behavior would be affected by their awareness of infectious source. The results showed that the effect did exist. Residents who knew rodent was the infectious source of HFRS tended to sweep barns more frequently (41.05% VS 20.31%, $p < 0.01$). Furthermore, when cleaning the barns whether the residents took personal protective measures was analyzed. The result indicated that 18.95% of the residents who knew that rodent were the infectious source took protective measures such as wearing a mask or gloves when sweeping the barns, while among the residents who did not know the

knowledge, only 10.16% of them took protective measures. The difference was statistically significant. 57.37% of residents who knew the infectious source would adopt measures to prevent the grain from being contaminated by rodents. However, only 25.00% of residents who didn't know the source of infection took precautions. The result showed that the proportion of drinking unboiled water was 8.42% among the residents who knew the infectious source. It was lower than the residents who did not know that. Among the residents who knew the source of infection, 88.42% would wash the quilt more frequently which was statistically higher than the residents who did not know the knowledge (Table 5).

Discussion

HFRS which is caused by HVs is a seriously global threat for public health. Rodents, shrews, and moles are the reservoir animals for HVs.⁹ China is the most severe endemic country in the world, accounting for about 90% of human cases.¹⁰ The Chinese government paid great attention to the prevention and control of HFRS, including rodent surveillance and control, public health education, environment management, and especially the free vaccination project in high endemic areas.⁸ Nevertheless, this investigation found that the residents' cognitions on HFRS and the infectious source were worrying. Only 17.71% of respondents knew about HFRS vaccine. More worryingly, the HFRS vaccination rate of the respondents was 0.0%. The reason may be that residents do not pay enough attention to vaccination. Several studies have shown a decline in vaccination willingness in China and the world.^{11,12} Furthermore, our research found that the cognition of the infectious source affected the residents' behaviors which have been proven to be helpful in preventing HFRS.¹³ It is gratifying that our survey showed that education was a favorable factor to improve residents' awareness of HFRS and relative knowledge. Similar to this study, a survey of U.S. adults indicated that people with a bachelor's degree or higher was significantly more likely to get COVID-19 vaccination.¹⁴ A systematic review indicated that interventions that delivered HPV-related education by authoritative sources and included parents improved HPV vaccination rates among adolescents and young adults.¹⁵ All the results suggested that, in the future, more attention should be paid to strengthen the publicity of HFRS prevention knowledge. The residents' awareness of protection should be improved, and good behaviors should be formed. And in particular, for the elderly farmers with low education level, pictures, videos and other vivid methods should be used for disease prevention publicity. Moreover, emphasis should be put on vaccine uptake. At present, the inactivated HFRS vaccines developed in China have been used in epidemic areas and have been proved to have good protective effects.¹³ It indicated that in endemic areas through community publicity to raise the vaccination rate would have a positive effect on the prevention of HFRS.

Conclusion

Our study demonstrated that education affected the residents' cognition of HFRS and related knowledge. Thus, more attention should be paid to promote residents' comprehensive health education in HFRS endemic areas.

Declarations

Ethics approval and consent to participate

Ethics Committee of Jining Medical University approved the investigation. The investigators ensured that each respondent fully understood the content of the study and volunteered to complete the survey.

Consent for publication

All authors read and approved the final manuscript.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

All authors have declared there were no conflicts of interest to disclose.

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Authors' contributions

Questionnaire design and survey: Wang WJ, Liu MM; Data analysis: Liu MM, Liu W; Wrote the paper: Liu MM; Revised the paper: Guo LY.

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Tables

Table 1. Demographic characteristics of the participants in different districts

		Jinxiang	Jiaxiang	Qufu	Sishui	chi-square	P
Gender	male	122	134	127	141	2.35	0.5
	female	96	85	98	89		
Profession	farmer	174	168	181	179	1.34	0.97
	migrant worker	33	37	33	37		
	unemployed	11	14	11	14		
Age group	<40	37	40	37	40	0.56	0.99
	40~	90	88	96	92		
	60~	91	91	92	98		
Education	primary school	94	97	97	102	0.25	0.99
	junior high school	99	98	102	103		
	technical secondary school	13	12	13	12		
	high school and above	12	12	13	13		
annual household income per capita	<10,000	79	68	83	76	2.57	0.98
	10,000~	74	84	76	86		
	30,000~	46	47	47	48		
	50,000~	19	20	19	20		
Nationality	Han	216	215	224	225	3.25	0.36
	Others	2	4	1	5		
Marital status	married	198	195	203	206	0.44	0.93
	others	20	24	22	24		

Table 2. Cognitive status of HFRS and related knowledge in different districts

		Jinxiang	Jiaxiang	Qufu	Sishui	chi-square	P
Cognition of HFRS	Yes	114	108	115	109	1.24	0.74
	No	104	111	110	121		
Cognition of infectious source	Yes	91	92	97	100	0.19	0.98
	No	127	127	128	130		
Cognition of the vaccine	Yes	34	45	33	46	4.14	0.25
	No	184	174	192	184		

Table 3. Cognitions of HFRS and related knowledge of the Participants

		Cognition of HFRS				Cognition of infectious source				Cognition of the vaccine			
		Yes	No	χ^2	<i>P</i>	Yes	No	χ^2	<i>P</i>	Yes	No	χ^2	<i>P</i>
Gender	male	278	246	4.74	0.03	252	272	15.66	<0.01	98	426	0.85	0.36
	female	168	200			128	240			60	308		
Profession	farmer	330	372	19.69	<0.01	290	412	8.80	0.01	118	584	5.66	0.06
	migrant worker	94	46			74	66			34	106		
	unemployed	22	28			16	34			6	44		
Age group	<40	94	60	23.10	<0.01	74	80	45.65	<0.01	34	120	10.26	0.01
	40~	200	166			196	170			76	290		
	60~	152	220			110	262			48	324		
Education	primary school	146	244	53.54	<0.01	116	274	55.46	<0.01	44	346	22.18	<0.01
	junior high school	234	168			202	200			92	310		
	technical secondary school	40	10			36	14			8	42		
	high school and above	26	24			26	24			14	36		
Annual household income per capita	<10,000	118	188	26.79	<0.01	104	202	21.33	<0.01	54	252	0.69	0.88
	10,000~	172	148			160	160			62	258		
	30,000~	114	74			90	98			38	150		
	50,000~	42	36			26	52			16	62		
Nationality	Han	442	440	0.41	0.53	376	506	0.03	0.87	158	724	1.12	0.29
	Others	4	6			4	6			0	10		
Marital status	married	402	400	0.05	0.82	332	470	0.92	0.34	142	660	0.00	0.99
	others	44	46			42	48			16	74		

Table 4. Multivariate analysis of cognitive status

	Cognition of HFRS			Cognition of the infectious source			Cognition of the vaccine		
	<i>B</i>	OR	95%CI	<i>B</i>	OR	95%CI	<i>B</i>	OR	95%CI
Constant	0.45	□	□	0.02	□	□	2.22	□	□
Gender(ref: male)	□	□	□	0.38	1.46	1.10-1.95	□	□	□
Age group(ref: <40)	0.25	1.29	1.05-1.57	0.37	1.46	1.19-1.79	□	□	□
Education (ref: primary)	-0.34	0.71	0.59-0.86	-0.45	0.64	0.53-0.78	-0.38	0.69	0.56-0.84
Family income per capita(ref: <10,000)	-0.21	0.81	0.70-0.94	□	□	□	□	□	□

Table 5. The influence of residents' cognition of infectious source on residents' behavior

		Cognition of the infectious source			
		Yes	No	χ^2	<i>P</i>
sweep the barn	Yes	156	104	45.43	<0.01
	No	224	408		
personal protections	Yes	72	52	14.08	<0.01
	No	308	460		
preventive measures against rats	Yes	218	128	96.25	<0.01
	No	162	384		
unboiled water	Yes	32	50	0.47	0.49
	No	348	462		
bask the quilt	Yes	336	402	14.98	<0.01
	No	44	110		