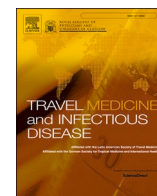




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Knowledge and vaccination intention of monkeypox in China's general population: A cross-sectional online survey

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ABSTRACT

Background: Public awareness of monkeypox is critical in the fight against this infectious disease. However, at present a survey of the Chinese population on monkeypox is lacking. This study was conducted to compensate for the lack of knowledge and identify a vaccination intention assessment for monkeypox in China.

Methods: The questionnaire comprised 20 items with the following three aspects: basic information, knowledge, and willingness to vaccinate or pay. For this study, 521 valid respondents were recruited. Utilizing logistic regression, the researchers identified the factors related with knowledge and vaccination intentions.

Results: The average total score for knowledge of monkeypox was 5.6 (score range 0–10), and 309 (59.3%) participants were categorized as having greater knowledge based on a total score of 6. Most participants (76.4%) were willing to accept a monkeypox vaccination. The average acceptable cost of the monkeypox vaccine was CNY261.2. Factors such as level of education, and working within the healthcare profession were related to monkeypox knowledge. An increased knowledge of monkeypox was related to a higher willingness to vaccinate. Participants who were willing to pay more for vaccines included those with high incomes, who suffered from chronic diseases, and healthcare workers.

Conclusions: The Chinese population had relatively high knowledge of monkeypox and demonstrated a willingness to receive the vaccine.

1. Introduction

Monkeypox is an emerging zoonotic disease caused by the monkeypox virus, an orthopoxvirus in the Poxviridae family [1]. In 1958, it was identified in captive cynomolgus monkeys living in Copenhagen [2]. The Democratic Republic of Congo reported its first patient infected with the monkeypox virus in 1971 [3]. Since then, monkeypox has only been regionally endemic in western and central Africa [4]. In 2022, a widespread outbreak of monkeypox occurred worldwide. Between January 1, 2022 to September 30, 2022, the Centers for Disease Control and Prevention of the United States reported 68,428 cases confirmed in 106 locations, 99 of which had never previously reported monkeypox [5]. On July 23, 2022, the World Health Organization declared the global outbreak of monkeypox to be a public health emergency of international concern [6]. Moreover, the Hong Kong Special

Administrative Region reported its first monkeypox case on September 6, 2022, while the Chinese mainland reported its first incidence of imported monkeypox on September 16, 2022 [7].

The general public's understanding of monkeypox is one of the prerequisites for controlling this epidemic. Prior research has revealed poor overall knowledge of monkeypox in the populations of Saudi Arabia, Indonesia, and Jordan [8–10]. A recent survey conducted in a northern Indian state revealed that nearly one-quarter of dental professionals had never heard of monkeypox [11]. During the epidemic, concerns were raised regarding the population vaccination status against monkeypox. Thus, prior to large-scale vaccination, it is vital to investigate the population's willingness to vaccinate (WTV), and willingness to pay (WTP) for the vaccine. According to a survey conducted in Indonesia, 96% of the investigated frontline physicians were willing to accept a free vaccination against monkeypox [12]. Moreover, after

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the WHO monkeypox alert, the majority of Saudi Arabian healthcare workers believed they should be vaccinated first [13].

Presently, a survey of the Chinese population's monkeypox knowledge and vaccination intention is still lacking. Due to the absence of an assessment of monkeypox-related knowledge in China, a national online survey was conducted to fill the void.

2. Materials and methods

2.1. Study design and participants

The survey was designed and conducted online to assess the general Chinese population's knowledge of monkeypox, as well as their vaccination intentions. From September 29, 2022 to October 5, 2022, data were collected using *wjx.cn*, a widely used online questionnaire survey platform in China, with approximately 6.2 million registered users [14]. This online survey was conducted using the sample service provided by the platform. The sampling method was simple random sampling, whereby the platform randomly sends invitations to individual registered users. Registered users can decide whether to answer the questions after receiving the survey. To guarantee that the sample was representative, the researchers required a platform that allowed them to invite respondents of different ages and from specific geographical locations. Prior to the survey, a brief explanation of the study's purpose and protocol was provided. Before completing the questionnaire, participants were required to read and confirm that they voluntarily agreed to answer it. Furthermore, they could withdraw their participation at any time while completing the questionnaire. Only completely answered questionnaires were submitted. Each device could only access the questionnaire once, a restriction enforced by *wjx.cn*, to ensure that each respondent only submitted one questionnaire.

The inclusion criteria were as follows: (1) Chinese citizens currently residing in China, (2) aged 18–60 years, (3) capable of independently reading and completing the self-administered questionnaire, and (4) willing to participate in the survey. All participants were anonymous adult volunteers. Thus, the survey posed no potential risk to participants' physical and mental health. Furthermore, this study adhered to the ethical principles of Measures for the Ethical Review of Biomedical Research Involving Humans of the National Health Commission of the People's Republic of China.

2.2. Sample size

A minimum sample size was calculated using Raosoft's sample size calculator [15]. The acceptable margin of error was 5%, and the confidence level was 95%. The response distribution was expected to be 50%. In May 2021, the population size in China is approximately 1.4 billion. In terms of the above parameters, the sample size n was given by:

$$x = Z(c/100)^2 r(100-r)$$

$$n = \frac{N x}{(N-1)E + x}$$

where N is the population size, r is the fraction of responses, and $Z(c/100)$ is the critical value for the confidence level c . Consequently, the minimum sample size was calculated to be 385. This study anticipated a 30% rate of invalid questionnaires, therefore at least 500 individuals were required to participate.

2.3. Measures

A concise and structured questionnaire was designed to investigate the Chinese population's monkeypox knowledge and vaccination intention. The questionnaire comprised 20 items, and the following three aspects (Supplemental Material 1):

- (1) Basic data (eight items), including age, gender, marital status, region, education level, monthly income, health status, and whether one is a healthcare worker.
- (2) Knowledge of monkeypox (ten items), in terms of etiology, epidemiology, clinical manifestations, and treatment. This was based on the 2022 guidelines for diagnosing and treating monkeypox in China. In this section, respondents rated statements as "true," "false," or "undecided." A score of one was awarded for a correct response, and 0 for an incorrect or "undecided" response. Respondents were grouped based on a total knowledge score of 6. Those with a score of 6 and above were assigned to the more knowledgeable group; otherwise, they were assigned to the less knowledgeable group. The reasoning behind using a score of 6 as a cut-off value was as follows: according to expert evaluation, there were three simple questions (all were expected to be answered correctly for a total score of 3 points), four medium difficulty questions (of which, 50% were expected to be answered correctly for a total score of 2 points), and three difficult questions (which were almost impossible to answer correctly, for a total score of 0 point). This implies that 5 scores would be the most obtainable score, therefore 6 scores demonstrated a score suitable as the cut-off value.
- (3) Monkeypox vaccination intention (two items), including WTV and WTP for vaccination. In the "WTV" question, the following response options were provided: "yes," "no," and "undecided." In the "WTP" question, respondents were grouped according to their WTP a fee of CNY500. Those willing to pay more than CNY500 were assigned to the higher WTP group; otherwise, respondents were assigned to the lower WTP group.

The questionnaire preparation process was based on prior research [16]. A pool of items was formed based on the survey dimensions. Subsequently, consultations with experts from different research fields were performed to develop a questionnaire based on the pool of items. Prior to the distribution of the final version of the questionnaire, it was first put through a pilot test.

2.4. Statistical analyses

Descriptive data are presented as median (25 quantile, 75 quantile), or as frequencies and proportions. Utilizing binary logistic regression, the researchers identified possible factors related to monkeypox knowledge, WTV, and WTP. The significance of the univariable model at the level of $P < 0.15$ was considered for entry into the multivariable model. The criterion for remaining in the model was set at $P < 0.05$. The regression's odds ratio (OR), and the respective 95% (CI) were estimated. In the multivariable logistic model, the events per parameters need to be greater than 10. Furthermore, collinearity was estimated by the expert panel based on actual relationships between the variables and assessed through the statistical factor of tolerance and variance inflation factor (VIF). Tolerance < 0.1 or $VIF > 10$ were considered to be indicative of serious multicollinearity. If serious multicollinearity exists, one of the variables must be excluded. All analyses were conducted on SPSS 25.0 (IBM Corporation, New York, NY, United States).

3. Results

3.1. Demographic characteristics

A total of 615 questionnaires were distributed to the registered users on the platform, of which 521 were valid (effective rate = 84.7%). Among the invalid questionnaires, 86 were excluded due to non-response, and 8 due to non-compliance with the response requirements. Demographics characteristics of the study respondents are shown in Table 1.

Table 1
Demographics characteristics of the study respondents.

Variables	N (%) or Median (P ₂₅ , P ₇₅)
Age (years)	30 (26, 35)
Gender	
Male	264 (50.7)
Female	257 (49.3)
Marital status	
Unmarried	165 (31.7)
Married and others	356 (68.3)
Region of China	
East	249 (47.8)
Central	122 (23.4)
West	109 (20.9)
Northeastern	41 (7.9)
Education level	
Junior high school (or below)	25 (4.8)
Bachelor's (or associate) degrees	455 (87.3)
Master's (or above) degrees	41 (7.9)
Monthly income	
<CNY1,000	21 (4.0)
CNY1,001–5000	130 (25.0)
CNY5,001–10,000	227 (43.6)
CNY10,001–20,000	112 (21.5)
≥CNY20,000	31 (6.0)
Chronic diseases	
No	419 (80.4)
Yes	102 (19.6)
Healthcare workers	
No	428 (82.1)
Yes	93 (17.9)

CNY: Chinese Yuan. CNY7 ≈ USD1.

3.2. Knowledge of monkeypox and associated factors

Fig. 1 shows the results of the questions addressing monkeypox knowledge. The average overall score for knowledge of monkeypox was 5.6 (score range 0–10; Fig. 2). Considering the cut-off score of 6 points, 212 (40.7%) participants were assigned to the group with less knowledge, while 309 (59.3%) participants were assigned to the group with more knowledge. Table 2 presents the results of the univariable and multivariable logistic regression analyses for knowledge-related factors. These findings show that having a higher education level and being a healthcare worker were related to having higher monkeypox knowledge.

3.3. Monkeypox vaccination intention and associated factors

A greater proportion of survey participants (76.4%) were willing to accept the monkeypox vaccine, conversely 6.7%, and 16.9% of the participants were unwilling to be vaccinated, and undecided, respectively. Those willing to pay not more than CNY100 accounted for 28.4%, whereas those willing to pay CNY101–500, CNY501–1,000, CNY1,001–2,000, and more than CNY2,000 constituted 45.5%, 15.7%, 7.1%, and 3.3%, respectively. Resultantly, the acceptable average cost of the monkey vaccine for the Chinese population in this study, if computed using a lower value in each group, was CNY261.2. The relationship between all demographic characteristics and WTV was statistically insignificant. However, there was an identifiable difference between the groups with less, or more monkeypox knowledge, and WTV (Table 3). Based on a cut-off value of CNY500, 385 participants were assigned to the lower WTP group, and 136 participants were assigned to the higher WTP group. Table 4 shows the results of the univariable and multivariable logistic regression for WTP-related factors. Higher WTP

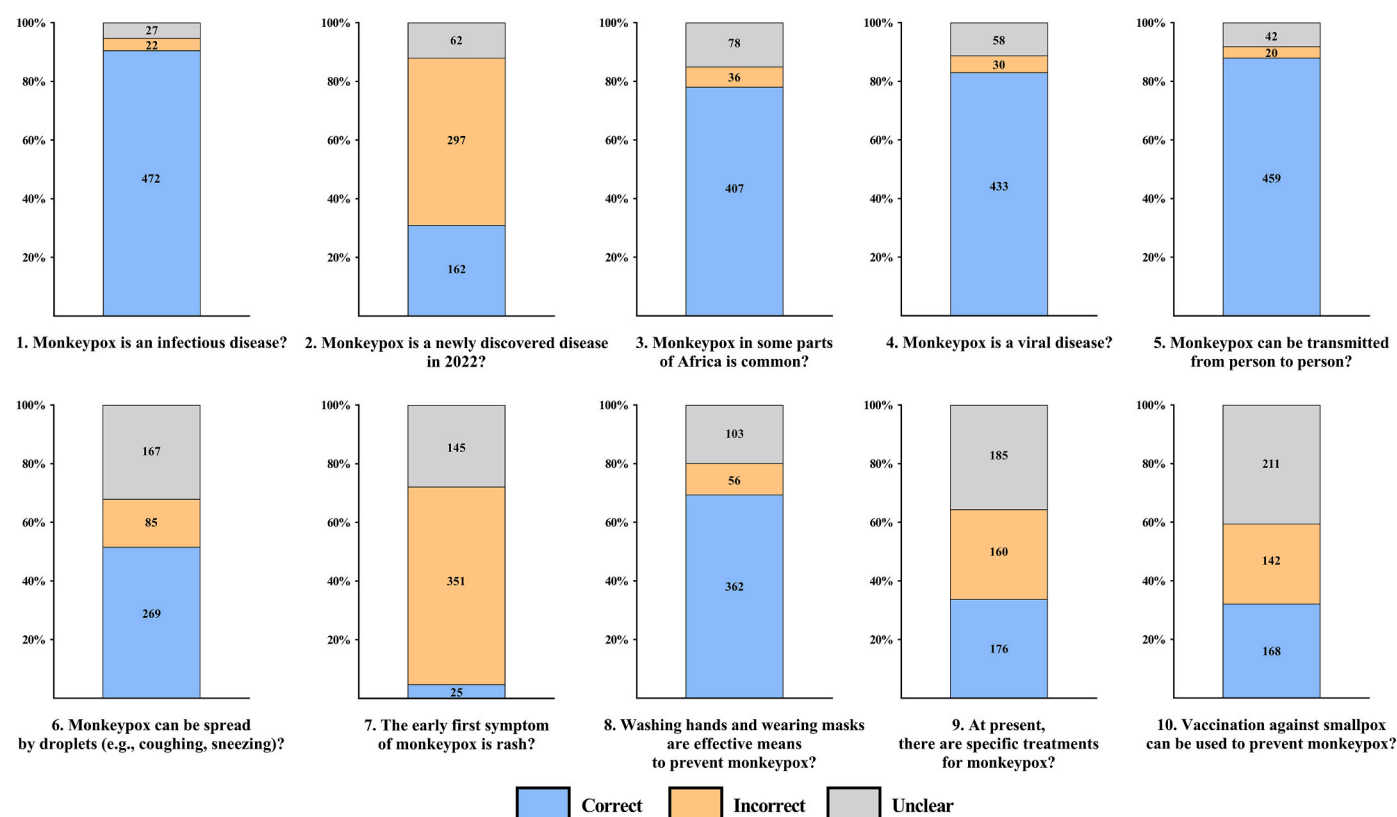


Fig. 1. Results of the ten questions for evaluating monkeypox knowledge. In the top row, from left to right, the first five questions are represented by five pieces. Questions 6–10 represent the other five pieces in the bottom row, from left to right. The numbers in the bar, which are colored blue, yellow, or grey, indicate the number of participants giving correct, incorrect, or undecided answers, respectively. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

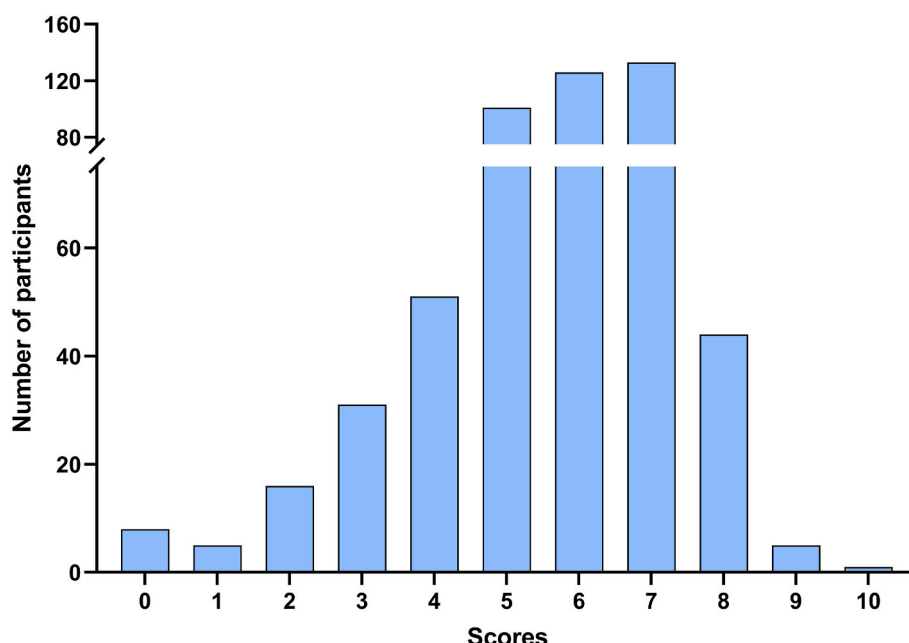


Fig. 2. Total scores of monkeypox knowledge. Respondents rated items as “true,” “false,” or “undecided”; one score was awarded for a correct response, and 0 for an incorrect answer or “undecided.” The total score is 10.

was related to higher monthly income, suffering from chronic diseases, and being a healthcare worker.

4. Discussion

A better understanding of monkeypox is critical for controlling its outbreak [17]. Surveys considering knowledge, attitudes, and practices related to monkeypox have previously been conducted in Saudi Arabia, Indonesia, and other countries [1,9]. However, in China, it is presently unclear how much information on monkeypox is appreciated among the general public, and whether there is willingness to accept the monkeypox vaccine. To the best of our knowledge, this is the first study of its kind to be completed in China. This national online survey has revealed relatively high levels of knowledge and WTV in the general Chinese population.

According to this study's queries, three-fifths of respondents had a greater knowledge of monkeypox than the remaining two-fifths. A survey conducted in Saudi Arabia indicated that only half of the respondents had high knowledge [8]. Over two-thirds of the healthcare workers in this study had higher knowledge of monkeypox, similar to the results of a survey conducted at Jordanian health schools [10]. It is recognized that there is varying knowledge of monkeypox within the healthcare profession worldwide. Using an 80% and 70% cut-off point for the knowledge domain, Harapan et al. demonstrated that only 10.0% and 36.5% of 432 general practitioners in Indonesia, respectively, had good knowledge [9]. According to Kaur et al., only 28% of the dental professionals in India had high knowledge scores [11]. This study's high knowledge rate is potentially attributable to the Chinese government's skillful propaganda efforts about monkeypox knowledge, and the simplicity of the test questions. Additionally, the Chinese participants in this survey had a solid understanding of the etiology and transmission route of monkeypox, as well as its symptoms, treatment, and prevention. Similarly, Sallam et al. discovered that only one-third of Jordanian respondents knew about the availability of a preventative vaccine to the monkeypox virus infection [18]. For items assessing virus transmission and non-cutaneous symptoms of the disease, an overall low monkeypox knowledge was identified in Saudi Arabia [19]. In Europe, where monkeypox is endemic, inadequate diagnosis and treatment may also be indicative of an inadequate understanding of the disease [20].

Consistent with a prior study, two factors related to monkeypox knowledge: level of education, and being a healthcare worker or not [8]. The highly educated, and medical staff, had greater knowledge about monkeypox, most likely because these two populations were well-informed and educated. Moreover, compared to other healthcare workers, physicians are considered to have greater knowledge [19].

Vaccination is among the most effective methods of controlling infectious diseases. In this study, nearly four-fifths of the respondents were willing to receive monkeypox vaccines. Moreover, most Saudi populations concurred that health officials should launch a vaccination campaign to combat monkeypox [21]. There were no baseline data associated with WTV but having greater monkeypox knowledge was related to higher WTV. Temsah et al. recognized that Saudi respondents with a high level of commitment to precautionary infection control measures, and those who were concerned about monkeypox infection, were considerably more likely to accept vaccination [22]. Moreover, vaccine safety considerations generally affect vaccine acceptance, which will be included in future studies. In this study, the mean WTP for vaccines against monkeypox in this study was USD37.3 using an exchange rate of CNY1.0 = USD7.0. Similarly, the mean WTP was USD37.0 in Indonesia, another heavily populated developing country [12]. Participants with high incomes, suffering from chronic diseases, and healthcare workers demonstrated a willingness to pay more for vaccines. The researchers concluded that income or economic status is a robust predictor of WTP, this conclusion is comparable to that in Harapan's study [12]. People with chronic diseases were willing to pay higher vaccine costs due to increased concern about their own health. Healthcare workers generally support applying tighter infection control measures to combat monkeypox disease; therefore, they were significantly more likely to support vaccination [13].

Based on this study's results, the following recommendations are made. 1) Publicity information regarding monkeypox should be enhanced for the general public through various media. 2) Clear and easy-to-learn monkeypox courses should be designed to teach healthcare workers to enhance their ability and confidence in managing human monkeypox cases. This is particularly relevant regarding clinical manifestations and diagnosis [23,24]. 3) Attention should be given to the vaccine needs of patients with chronic diseases, and healthcare workers who may have higher safety requirements. Additionally, based on the

Table 2
The results of logistic regression for monkeypox knowledge related factors^a.

Variables	Univariable		Multivariable	
	OR (95% CI)	p Value	OR (95% CI)	p Value
Age, years				
18–27	Reference		Reference	
28–37	0.70 (0.47–1.04)	0.080	0.70 (0.47–1.05)	0.084
38–47	0.89 (0.46–1.72)	0.734	0.98 (0.50–1.90)	0.944
≥48	0.65 (0.27–1.54)	0.323	0.73 (0.30–1.77)	0.489
Gender				
Male	Reference		NI	
Female	1.09 (0.77–1.54)	0.646		
Married status				
Unmarried	Reference		NI	
Married and others	1.03 (0.71–1.50)	0.869		
Region				
East	Reference		NI	
Central	0.93 (0.60–1.45)	0.761		
West	1.30 (0.81–2.07)	0.277		
Northeast	0.73 (0.38–1.41)	0.349		
Education Level				
high school and below	Reference		Reference	
Bachelor (including associate)	2.19 (0.96–4.98)	0.062	2.17 (0.94–5.00)	0.070
Master or above	3.63 (1.27–10.31)	0.016	3.50 (1.21–10.12)	0.021
Monthly income, CNY				
≤5000	Reference		NI	
5001–20000	1.17 (0.80–1.73)	0.420		
>20,000	1.41 (0.63–3.15)	0.400		
Chronic diseases				
No	Reference		NI	
Yes	1.20 (0.77–1.87)	0.431		
Healthcare workers				
No	Reference		Reference	
Yes	1.75 (1.08–2.84)	0.023	1.69 (1.04–2.76)	0.036

^a The group with less knowledge was assigned a value of 0, and the group with more knowledge was assigned a value of 1. Events per parameter of multivariable logistic regression model was 71. CI: confidence interval; OR: odds ratio; NI: not included; CNY: Chinese Yuan.

results of the factor analysis related to knowledge and vaccine intention, we suggest that prior to the next monkeypox pandemic, more extensive knowledge popularization should be carried out for those of low-education levels, low-incomes, and non-medical personnel. Simultaneously, providing vaccines of different prices for different groups may help promote vaccination and thus establish a group immune barrier.

This study has several limitations. First, the results cannot be generalized to other countries because the study was conducted solely in China. Second, although the researchers conducted a large-sample random sampling survey through an authoritative online survey platform, the registered users on this platform only represented a part of the Chinese population, and this increased this study's selection bias to a certain extent. In the survey, the respondents who took part in online survey were educated, knowledgeable, and demonstrate digital literacy. Unfortunately, due to insufficient funding, conducting the survey with a larger population was impossible. Third, this study can only represent the current situation because the monkeypox epidemic is continually

Table 3
The results of logistic regression for monkeypox WTV related factors^a.

Variables	Univariable		Multivariable	
	OR (95% CI)	p Value	OR (95% CI)	p Value
Age, years				
18–27	Reference		NI	
28–37	1.01 (0.64–1.60)	0.961		
38–47	0.86 (0.41–1.78)	0.681		
≥48	0.73 (0.28–1.90)	0.521		
Gender				
Male	Reference		NI	
Female	0.80 (0.53–1.20)	0.272		
Married status				
Unmarried	Reference		NI	
Married and others	1.34 (0.87–2.04)	0.181		
Region				
East	Reference		NI	
Central	1.17 (0.70–1.95)	0.558		
West	0.96 (0.57–1.61)	0.874		
Northeast	1.93 (0.78–4.82)	0.157		
Education Level				
High school and below	Reference		NI	
Bachelor (including associate)	1.03 (0.40–2.64)	0.956		
Master or above	0.98 (0.31–3.13)	0.971		
Monthly income, CNY				
≤5000	Reference		Reference	
5001–20000	1.25 (0.80–1.93)	0.324	1.22 (0.78–1.90)	0.388
>20,000	2.52 (0.83–7.63)	0.103	2.41 (0.79–7.37)	0.124
Chronic diseases				
No	Reference		NI	
Yes	1.34 (0.78–2.29)	0.290		
Healthcare workers				
No	Reference		NI	
Yes	1.47 (0.83–2.60)	0.184		
Monkeypox knowledge				
Less	Reference		Reference	
More	2.18 (1.45–3.29)	<0.001	2.16 (1.43–3.26)	<0.001

^a In logistic regression, the group unwilling or undecided on vaccination was assigned a value of 0, and the group willing to vaccinate was assigned a value of 1. Events per parameter of multivariable logistic model was 62. WTV: willingness to vaccinate; CI: confidence interval; OR: odds ratio; NI: not included.

evolving. Ongoing investigation of the general population is still required. Nevertheless, this study provides nationwide cross-sectional data for developing monkeypox-related education and vaccine programs.

5. Conclusion

In this study, the knowledge of monkeypox and willingness to receive the monkeypox vaccine was relatively high among the Chinese population. Education level and being a healthcare worker were identifiable factors related to monkeypox knowledge. Furthermore, higher monkeypox knowledge was related to higher WTV. Participants with high incomes, suffered chronic diseases, and were healthcare workers were willing to pay more for vaccines.

Table 4
The results of logistic regression for monkeypox WTP related factors^a.

Variables	Univariable		Multivariable	
	OR (95% CI)	p Value	OR (95% CI)	p Value
Age, years				
18–27	Reference		Reference	
28–37	2.02 (1.26–3.22)	0.003	1.03 (0.55–1.92)	0.925
38–47	1.74 (0.83–3.62)	0.140	0.94 (0.39–2.26)	0.894
≥48	0.89 (0.29–2.81)	0.847	0.44 (0.12–1.59)	0.210
Gender				
Male	Reference		NI	
Female	0.78 (0.53–1.16)	0.225		
Married status				
Unmarried	Reference		Reference	
Married and others	2.54 (1.57–4.10)	<0.001	1.83 (0.97, 3.49)	0.064
Region				
East	Reference		NI	
Central	1.03 (0.63–1.67)	0.910		
West	0.71 (0.42–1.22)	0.216		
Northeast	0.98 (0.46–2.06)	0.949		
Education Level				
High school and below	Reference		Reference	
Bachelor (including associate)	3.94 (0.91–16.95)	0.066	2.67 (0.59–12.00)	0.200
Master or above	9.00 (1.87–43.31)	0.006	4.24 (0.80–22.40)	0.089
Monthly income, CNY				
≤5000	Reference		Reference	
5001–20000	3.18 (1.85–5.48)	<0.001	2.52 (1.37–4.61)	0.003
>20,000	7.88 (3.34–18.61)	<0.001	5.03 (1.93–13.15)	0.001
Chronic diseases				
No	Reference		Reference	
Yes	3.00 (1.91–4.73)	<0.001	2.00 (1.18–3.38)	0.010
Healthcare workers				
No	Reference		Reference	
Yes	3.10 (1.94–4.95)	<0.001	2.71 (1.57–4.68)	<0.001

^a In logistic regression, the group with lower WTP was assigned a value of 0, and the group with higher WTP was assigned a value of 1. Events per parameter of the multivariable logistic model was 23. WTP: willingness to pay; CI: confidence interval; OR: odds ratio; NI: not included; CNY: Chinese Yuan.

CRedit authorship contribution statement

Chen Dong: Methodology, Formal analysis, Investigation, Writing – original draft, Visualization. **Zhou Yu:** Methodology, Formal analysis, Investigation, Writing – original draft, Visualization. **Ying Zhao:** Conceptualization, Methodology, Writing – review & editing, Project administration. **Xianjie Ma:** Conceptualization, Methodology, Writing – review & editing, Project administration.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.tmaid.2022.102533>.

References

- [1] Cheng K, Zhou Y, Wu H. Bibliometric analysis of global research trends on monkeypox: are we ready to face this challenge. *J Med Virol* 2022. :e27892.
- [2] Pv Magnus, Andersen EK, Petersen KB, Birch-Andersen AA. POX-LIKE disease in cynomolgus monkeys. *Acta Pathol Microbiol Scand* 1959;46(2):156–76.
- [3] Ladnyj ID, Ziegler P, Kima E. A human infection caused by monkeypox virus in Basankusu Territory, Democratic Republic of the Congo. *Bull World Health Organ* 1972;46(5):593–7.
- [4] Soheili M, Nasser S, Afraie M, Khateri S, Moradi Y, Mahdavi Mortazavi SM, et al. Monkeypox: virology, pathophysiology, clinical characteristics, epidemiology, vaccines, diagnosis, and treatments. *J Pharm Pharmaceut Sci* 2022;25:297–322.
- [5] The Centers for Disease Control and Prevention. 2022 monkeypox outbreak global map. <https://www.cdc.gov/poxvirus/monkeypox/response/2022/world-map.html>. [Accessed 1 October 2022].
- [6] World Health Organization. WHO Director-General's statement at the press conference following IHR Emergency Committee regarding the multi-country outbreak of monkeypox - 23 July 2022. <https://www.who.int/news-room/speeches/item/who-director-general-s-statement-on-the-press-conference-following-IHR-emergency-committee-regarding-the-multi-country-outbreak-of-monkeypox-23-july-2022>. [Accessed 1 October 2022].
- [7] Chinadaily. Chongqing reports an imported monkeypox case. <https://www.chinadaily.com.cn/a/202209/16/WS63246a4ba310fd2b29e78271.html>. [Accessed 1 October 2022].
- [8] Alshahrani NZ, Alzahrani F, Alarifi AM, Algethami MR, Alhumam MN, Ayied H, et al. Assessment of knowledge of monkeypox viral infection among the general population in Saudi Arabia. *Pathogens* 2022;11(8):904.
- [9] Harapan H, Setiawan AM, Yufika A, Anwar S, Wahyuni S, Asrizal FW, et al. Knowledge of human monkeypox viral infection among general practitioners: a cross-sectional study in Indonesia. *Pathog Glob Health* 2020;114(2):68–75.
- [10] Sallam M, Al-Mahzoum K, Dardas LA, Al-Tammami AB, Al-Majali L, Al-Naimat H, et al. Knowledge of human monkeypox and its relation to conspiracy beliefs among students in Jordanian health schools: filling the knowledge gap on emerging zoonotic viruses. *Medicina (Kaunas)* 2022;58(7):924.
- [11] Kaur A, Goel R, Singh R, Bhardwaj A, Kumari R, Gambhir RS. Identifying monkeypox: do dental professionals have adequate knowledge and awareness. *Rocz Panstw Zakl Hig* 2022;73(3):365–71.
- [12] Harapan H, Wagner AL, Yufika A, Setiawan AM, Anwar S, Wahyuni S, et al. Acceptance and willingness to pay for a hypothetical vaccine against monkeypox viral infection among frontline physicians: a cross-sectional study in Indonesia. *Vaccine* 2020;38(43):6800–6.
- [13] Ajman F, Alenezi S, Alhasan K, Saddik B, Alhaboob A, Altawil ES, et al. Healthcare workers' worries and monkeypox vaccine advocacy during the first month of the WHO monkeypox alert: cross-sectional survey in Saudi Arabia. *Vaccines (Basel)* 2022;10(9):1048.
- [14] Ning L, Niu J, Bi X, Yang C, Liu Z, Wu Q, et al. The impacts of knowledge, risk perception, emotion and information on citizens' protective behaviors during the outbreak of COVID-19: a cross-sectional study in China. *BMC Publ Health* 2020;20(1):1751.
- [15] Raosoft. com. Sample size calculator by Raosoft, Inc. <http://www.raosoft.com/samplesize.html>. [Accessed 7 October 2022].
- [16] Dong C, Yu Z, Liu W, Zhang Y, Zhang Z, Zhang L, et al. Impact of COVID-19 social distancing on medical research from the perspective of postgraduate students: a cross-sectional online survey. *PeerJ* 2022;10:e13384.
- [17] Riopelle JC, Munster VJ, Port JR. Atypical and unique transmission of monkeypox virus during the 2022 outbreak: an overview of the current state of knowledge. *Viruses* 2022;14(9):2012.
- [18] Sallam M, Al-Mahzoum K, Al-Tammami AB, Alkurtas M, Mirzaei F, Kareem N, et al. Assessing healthcare workers' knowledge and their confidence in the diagnosis and management of human monkeypox: a cross-sectional study in a middle eastern country. *Healthcare (Basel)* 2022;10(9):1722.
- [19] Alsanafi M, Al-Mahzoum K, Sallam M. Monkeypox knowledge and confidence in diagnosis and management with evaluation of emerging virus infection conspiracies among health professionals in Kuwait. *Pathogens* 2022;11(9):994.
- [20] Grothe JH, Cornely OA, Salmanton-García J. Monkeypox diagnostic and treatment capacity at epidemic onset: a VACCCELERATE online survey. *J Infect Public Health* 2022;15(10):1043–6.
- [21] Meo SA, Al-Khlaiwi T, Aljofan ZF, Alanazi AI, Meo AS. Public perceptions of the emerging human monkeypox disease and vaccination in Riyadh, Saudi Arabia: a cross-sectional study. *Vaccines (Basel)* 2022;10(9):1534.
- [22] Temsah MH, Aljamaan F, Alenezi S, Alhasan K, Saddik B, Al-Barag A, et al. Monkeypox caused less worry than COVID-19 among the general population during the first month of the WHO Monkeypox alert: experience from Saudi Arabia. *Travel Med Infect Dis* 2022;49:102426.
- [23] Bass J, Tack DM, McCollum AM, Kabamba J, Pakuta E, Malekani J, et al. Enhancing health care worker ability to detect and care for patients with monkeypox in the Democratic Republic of the Congo. *Int Health* 2013;5(4):237–43.
- [24] Harapan H, Setiawan AM, Yufika A, Anwar S, Wahyuni S, Asrizal FW, et al. Confidence in managing human monkeypox cases in Asia: a cross-sectional survey among general practitioners in Indonesia. *Acta Trop* 2020;206:105450.