Analysis of Residents' Willingness to Vaccinate Against Covid-19 Vaccine and Its Influencing Factors in Hubei Province

Ruoxi Wan[1], Guangyan Wu[1], Zehan Ma[1], Feigen Yu[1]

[1]South-Central People University, Wuhan, 430074, China

Abstract: At present, COVID-19 epidemic prevention and control in China has achieved a stage victory. In order to prevent the domestic epidemic from spreading again, the promotion of vaccine vaccination and the establishment of herd immunity have become the top priority of the current anti-epidemic work. To understand residents in hubei province to new crown vaccination intention and its influence factors, carried out in hubei province residents new crown vaccine will and influence factors of the investigation, using the Pearson correlation analysis, binary logistic regression, text mining technology to analyze the data, it is concluded that gender, age, income, have bigger influence on the willingness to vaccination; The residents of Hubei Province and the whole country have different concerns about the vaccination of COVID-19 vaccine. The residents of Hubei Province mainly pay attention to the side effects of the vaccine, while the residents of China pay more attention to the effectiveness of the vaccine.

1. Introduction

Purpose and significance of the investigation

In order to understand the inoculation intention and influencing factors of Novel Coronavirus vaccine among residents in Hubei Province, questionnaire survey and text mining were conducted among residents in Hubei Province, and the collected data were modeled and analyzed to provide reference for the relevant departments in Hubei Province to formulate the vaccination plan and specific implementation measures of Coronavirus vaccine.

2. Objects and Methods of Investigation

2.1 Objects of Investigation

The respondents of this questionnaire survey are the residents of Hubei Province. The residents of Hubei Province are the legal citizens who have valid household registration of cities in Hubei Province and live in urban areas permanently. The areas where the residents of counties, townships and towns live are all classified as the central cities where they are located. The questionnaire was

issued through the official platform of Wenjuan.com. The questionnaire was designed to be filled out by all residents in Hubei Province.

The objects of text mining are the netizens all over the country.

2.2 Survey Methods

2.2.1 Questionnaire Survey

The questionnaire is mainly divided into five categories: basic personal information, influence of COVID-19 and risk prediction, vaccination situation, vaccination intention, and reasons for influencing vaccination intention.

Questionnaires were distributed through the official platform of wenjuan.com according to the number of more than 100 questionnaires issued by prefecture-level cities respectively. The questionnaires were distributed from 13:00 on March 5, 2021 to 13:00 on April 5, 2021. A total of 1,836 valid questionnaires were collected, excluding invalid questionnaires with less than 15s response time.

The reliability and validity of the questionnaire were tested, Cronbach α=0.705 and KMO = 0.643. The questionnaire was valid and data analysis could be conducted.

2.2.2 Text Mining

Using the network "crawler" technology, we searched the post or comment data about "Coronavirus vaccine" on Baidu Tieba, Sina Entertainment, Weibo and other platforms, and selected a total of 8,542 pieces of data. After data cleaning and elimination, we got a total of 7,643 valid pieces of data for text analysis.

3. Survey Results

3.1 Different Education Levels Are Affected by the Epidemic

Based on the survey and analysis, it can be seen that the majority of people with primary school, junior high school, high school/technical secondary school/technical school education think that their lives are seriously affected by the epidemic, while those with undergraduate or junior college education and graduate degree or above think that their lives are moderately affected by the epidemic. The higher the education, the less affected their lives are by the epidemic. Therefore, the team proposed a plan to improve the vaccination rate, that is, to improve the education level of the audience.

3.2 The Willingness of Different Income Levels to Vaccinate Against Covid-19

The majority of people are willing to be vaccinated against COVID-19 vaccine, and those who are unwilling to be vaccinated mainly concentrate in the population with the income/living expense level of 2000-7000 yuan. Low-income people and high-income people are more willing to be vaccinated. Hubei province to do a good job of vaccination work in the middle - income population.

3.3 Correlation Analysis of Gender, Educational Background, Age, City, Occupation, Income and Marital Status on Willingness Degree

3.3.1 Pearson Correlation Test

Pearson correlation coefficient is an index to measure the correlation between two data. The correlation between two data can help people understand the changing rules of things to some extent. Pearson correlation coefficient is defined as

$$r = \frac{\text{cov}(X,Y)}{\sqrt{D(X)} \cdot \sqrt{D(Y)}} = \frac{E((X-EX)(Y-EY))}{\sqrt{D(X)} \cdot \sqrt{D(Y)}}$$

3.3.2 Result Analysis

We use SPSS software to analyze the correlation between different genders, educational background, age, city, occupation, income and marital status on willingness, and get the following results.

Table 1 Pearson Correlation Analysis Results

		Sex	Edu	Age	City	Job	I	M
W	Pearson correlation	-.010	.617	-.554	-.410	.244	-.788	-.436
	Significant (double tail))	.559	.026	.048	.557	.451	.031	.542
	Number of cases	836	836	836	836	836	836	836

**. At the level of 0.01 (double-tailed), the correlation was significant
*. At the level of 0.05 (double-tailed), the correlation was significant
- Negative correlation
According to the correlation results, it can be seen that gender, city, occupation and marital status are not significantly correlated with vaccination willingness, while the significant P values of education background, age and income are all below 0.05, which are more significantly correlated with vaccination willingness.

3.4 The Influence Degree of Different Factors

3.4.1 Binary Logistic Regression Model

In the independent variables, the city according to the above standard, professional set to continuous numerical value, and the gender, age, education, income and marital status according to the different levels is set to type numerical, and willing to vaccination for the independent variable, the different classification variables or continuous variables as to whether to vaccination of probability.

3.4.2 Result Analysis

First, the fitting effect of the observed values and the regression model was verified by Hosmer-Lemshaw test (Hausman). The basic idea of Hausman test is as follows: the omission of relevant variables often leads to the simultaneous correlation between explanatory variables and random disturbance terms, i.e

$$C \text{ov}(X_t, U_t) \neq 0 \qquad (8)$$

Here are the test results we got:

Table 2 Hosmer-Lemshaw Test (Hausman) Test Results

Chi-square	Degrees of freedom	Significant
7.476	8	.486

It can be seen here that under the condition that the confidence level is 95%, the significance P value is 0.486, greater than 0.05. The original hypothesis is accepted, indicating that the fitting condition of observed data and regression model is good. Next, the obtained binary logistic regression results are sorted out and some important factors are selected for result analysis.

Table 3 Binary Logistic Regression Results

variable	β	Wald Chi-square value	P	OR Value(95% CI)
Sex	-0.42	0.021	0.267	1.000 0.562(0.442~0.978)
Edu(2)	0.122	2.245	0.033	1.000 1.930(1.249~2.740)
Age(1)	0.234	5.510	0.019	1.000 7.989(1.409~45.298)
City	0.023	2.315	0.032	1.000 1.204(0.298~3.853)
Job	0.033	0.045	0.663	1.000 0.239(0.026~0.782)
I(4)	0.567	4.921	0.024	1.000 1.149(0.714~1.661)
M	0.023	0.901	0.899	1.000 0.384(1.105~2.724)

Through regression, it is concluded that only EDU (2), AGE (1), CITY and I(4) have significance, and the significance P value is less than 0.05 when the confidence level is 95%.

EDU (2) indicates that the probability that people with a high school/technical school education or above is 1.930 times higher than that of those with a junior high school education.

AGE (1) indicates that people aged between 16 and 25 are 7.989 times more likely to be vaccinated than those with one unit younger, that is, primary school education or below.

The higher the GDP is, the greater the negative value will be. Therefore, the City here is a continuous variable. Here it means that the higher the GDP value of the prefecture-level City in Hubei Province is, the greater the willingness to vaccinate will be.

I(4) indicates that people with an income of 4000-5000 (inclusive) are 0.149 times more willing to be vaccinated than those with an income of 3000-4000 (inclusive).

3.5 Reasons for Not Being Willing to Vaccinate

Through Python text mining and data cleaning, and regular expression matching, Chinese was extracted separately. We picked out the sensitive words and characteristic keywords in the comments, such as second needle, effective, protection period, and other words, and counted the word frequency of the keywords.

Through the comparison of the CIV cloud map and the previous questionnaire survey results, it can be seen that the Chinese netizens and the residents of Hubei Province pay different attention to the COVID-11 vaccination. The residents of Hubei Province pay more attention to the side effects caused by the vaccination, while the Chinese residents generally pay more attention to the effectiveness of the vaccine, such as the duration of protection and so on.

4. Discussion

The survey results showed that 92.83% of Hubei residents were willing to receive COVID-19 vaccine. Education background, age and income had greater influence on the willingness to inoculate.

Respondents rated their reasons for not getting vaccinated, and those who did not were more worried about side effects. Through the comparison of the text mining data and the results of the questionnaire survey, we know that the residents of Hubei Province and the whole country have different concerns about the vaccination of the COVID-17 vaccine. The residents of Hubei Province mainly focus on the side effects of the vaccine, while the residents of the whole country pay more attention to the effectiveness of the vaccine.

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