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Taiwanese People's Decision to Vaccinate against COVID-19: The Impact of Information Source on Vaccination Decisions

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Abstract The success of the vaccination program depends on the coverage rate of the group. However, vaccination decision-making is a complex and dynamic issue that is affected by various factors. In addition to personal knowledge and attitudes about viruses and vaccines, it is also affected by the social environment, such as how the media describe the pandemic changes and the effectiveness of vaccines in news. The main purpose of this study is as follows. (1) To evaluate the decision-making of people in Taiwan to receive the COVID-19 vaccine and its influencing factors when a vaccine is available during the Level 3 alert period. (2) To understand whether the type of public access to COVID-19 information is related to the COVID-19 vaccine decision. This is a cross-sectional study. The study period is from June 30 to July 30, 2021, which is the Level 3 alert period in Taiwan. The subjects of the study are over 18 years old and live in Taiwan. Eventually 1,108 participants were included in the analysis. Chi-square, odds ratio, and binary logistic regression were used for the analysis. Overall, 88.62% of the participants expressed their willingness to receive the vaccine. The results of the study found that the willingness of vaccination has nothing to do with socio-demographic factors. The factors related to the willingness of vaccination are the degree of chronic disease, whether there is currently a vaccination insurance or anti-pandemic insurance, and attitudes and beliefs about COVID-19. For every 1-point increase in the Attitudes and Belief Scale scores, the odds of being willing to be vaccinated increase by 1.7 times. In addition, the type of information source is also related to the vaccination willingness, especially from official information, including the "Press Conference of the Department of Disease Control", "Ministry of Health and Welfare website, Facebook or LINE", "President's Facebook or LINE", "The Facebook or LINE of the heads of counties and cities." After controlling the attitudes and beliefs about COVID-19, the degree of chronic disease and the availability of related insurance, participants who came into contact with the CDC press conference were 1.539 times more likely to be willing to be vaccinated than other participants, and those who came into contact with the Facebook or LINE of the heads of counties and cities were 2.401 times more likely than other participants.

Keywords: *COVID-19, vaccination decision, information dissemination, binary logistic regression analysis*

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1. Introduction

After the first confirmed case of a new type of coronavirus appeared in Wuhan, China at the end of 2019, the coronavirus disease (COVID-19) quickly spread to all parts of the world, posing unprecedented challenges to the public health systems of all countries. The World Health Organization (WHO) declared the Coronavirus Disease (COVID-19) a Public Health Emergency of International Concern (PHEIC) on January 30, 2020, calling on all countries to take urgent action to combat the spread of the virus [1]. Based on its successful SARS prevention experience in the past, Taiwan immediately adopted effective measures to combat COVID-19 at the beginning of the outbreak, such as early screening, effective isolation/quarantine methods, digital technology to identify potential cases, contact tracing, and mandatory mask wearing, etc. [2], which prevented a comprehensive blockade.

Compared with other countries, Taiwan's pandemic has been well controlled and is listed as one of the countries with medium economic impact. In 2020, the gross domestic product (GDP) fell by less than 1% [3]. However, the vaccination program is still one of the most cost-effective public health interventions to achieve herd immunity, and it is often listed as one of the priority strategies for the control of infectious diseases by public health decision makers [4]. Therefore, vaccination for

more than 80% of the population is necessary (Sanche et al., 2020), but this can only be achieved when the public has a high degree of acceptance or low hesitation to vaccination.

The public's attitude towards vaccines is does not take the binary form of support and opposition, but is rather a continuous spectrum between these two extremes [5], such as the acceptance of some/all vaccines, rejection of some/all vaccines, and delayed decision. These "hesitant" people may reject certain vaccines, but agree to other vaccines, delay vaccination, or accept vaccines but are not sure whether they will eventually receive vaccines [6,7]. The WHO Strategic Advisory Group of Experts (SAGE) defines the vaccine decision-making behavior of "delaying or rejecting vaccines even if there is a vaccination service" as "vaccine hesitation" [8,9]. The determinants of vaccine hesitation are numerous and vary from case to case, not only by region and vaccine type [5,8], but also by the interaction between other factors, such as complacency, convenience, and confidence [5].

The public's negative and uncertain attitudes towards vaccines or unwillingness to vaccinate are the biggest obstacles to long-term management of the COVID-19 pandemic [10]. Therefore, for policy makers in various countries, prior to launching large-scale vaccination plans, it is necessary to determine the people's attitude towards vaccines and the factors affecting them. The acceptance of the COVID-19 vaccine varies greatly from country to country. According to the current research findings, China's acceptance of vaccines is the highest at nearly 90%, that of Russia is less than 55% [11], that of the United States is 67% [12], and that of the UK is 64% [13]. In Hong Kong, it is even lower at only 37.2% [14]. There are few studies on the acceptance of COVID-19 vaccine in Taiwan. As far as we know, there is only one [15]. The results of the study show that the Taiwanese people's acceptance of vaccines is lower than other high-income countries, with only 52.7% of participants willing to receive the COVID-19 vaccine, mainly due to the impact of past vaccination experience. The groups that are unwilling to receive the COVID-19 vaccine are the elderly, women, and participants with higher education levels. In addition, Taiwanese people's perception of the COVID-19 risk is negatively related to their willingness to receive the COVID-19 vaccine. This is the biggest difference from past research results [16]. Participants who are unwilling to be vaccinated respond to COVID-19 by adopting more non-invasive personal health protection behaviors, such as washing hands, wearing masks, and maintaining a safe social distance.

Although the vaccine acceptance is low, this does not mean that Taiwanese people are "vaccine hesitant", because the study period is from October 19 to 30, 2020, and at that time, the Taiwan government had not yet obtained a usable COVID-19 vaccine and the large-scale vaccination plan has not yet started. In addition, at that time, Taiwan was still in a situation of "zero diagnosis in the country." The current study period is from June 30 to July 26, 2021. June 30 is the 43rd day when the country enters the Level 3 alert [30], and the mass vaccination plan has been implemented. Based on past studies, it is known that vaccine hesitant behavior will vary with time, location, and vaccine [17], so during the rapid increase in number of people infected in Taiwan (when the pandemic was relatively serious), we conducted this nationwide survey to understand what the people's decisions about vaccination against COVID-19 were. Do these demographic variables still have statistical explanatory power? This is the first research purpose of this study.

During the study period, Taiwan's mass vaccination plan had not only been implemented, but those with a higher priority could even have Moderna and Astra Zeneca COVID-19 vaccines to choose from. Since the side effects, effectiveness, and safety of each vaccine are not the same, the more types of vaccines there are, the higher the complexity of decision-making. In order to reduce information asymmetry and decision-making uncertainty, the general public will collect information through multiple channels, such as the Internet, which is currently the main source of information for the public [5]. Media communication plays an important role in vaccine decision-making. Vaccination decision-making is influenced by positive or negative media comments. Negative reports will weaken the community's enthusiasm for vaccination [18]. The impact of media coverage varies from country to country. In Nigeria [19,20], India [21] and Bangladesh [22], the media is considered to be vaccinated promoters, while in Taiwan [23] and Canada [24], news reports about vaccination, especially negative reports, can cause vaccination obstacles. The type of media is also related to the decision-making behavior of the people. Foreign studies have shown that participants who have a high degree of trust in information from the government tend to receive the vaccine [11]. Therefore, this study investigated the different types of information channels used by participants to obtain information about the pandemic and vaccines and assessed whether the types of information channels are related to the people's acceptance of the COVID-19 vaccine. This is the second purpose of this research.

In summary, the purpose of this study is to (1) understand the acceptance of the COVID-19 vaccine by the people of Taiwan under the circumstances of changing environmental conditions (with two vaccines available during the Level 3 alert period) and explore the possible impact factors; (2) explore the impact of the type of information channel on people's acceptance of the COVID-19 vaccine.

2. Materials and Methods

2.1. Research Design

This is a cross-sectional study, and the study period is from June 29 to August 8, 2021. The Taiwan Centers for Disease Control and Prevention (TCDC) of the Taiwan Ministry of Health and Welfare raised the pandemic alert to Level 3 on May 19, until July 27. During this period, systematic nationwide sample surveys cannot be conducted, and online surveys were the most suitable method for evaluating large populations. We used the Survey Cake platform to collect data online.

The first page of the questionnaire is general information such as the purpose of the research and the

consent statement. Participants are residents who are over 18 years old and live in Taiwan.

To reach participants from different age groups, areas of residence, and different industries, this study also adopted a variety of strategies to recruit questionnaire participants, including contacting community leaders and influencers on social media through personal networks of researchers and relatives and friends to share this questionnaire. The reason for using the Facebook and Line platforms as the dissemination of online questionnaires is because the personal Internet access rate of all people over 12 years old in Taiwan is 86.2% [29], and the survey report of the Council of Information pointed out Facebook and Line are the two most frequently used platforms by more than 80% of Taiwanese people [25].

According to the visitor record data provided by the Survey Cake platform, a total of 2,950 people visited during the survey period, and 1,114 people completed the survey (the response rate was 37.7%). Excluding incomplete responses, 1,108 participants were eventually included in the analysis. Participants who completed the questionnaire did not receive any prizes or bonuses.

2.2. Measurement

The questionnaire used in this study consists of four parts: (1) Participants' personal and clinical characteristics; (2) Beliefs and attitudes to COVID-19; (3) Types of information sources; (4) Vaccination decisions.

2.2.1. Personal and Clinical Characteristics

We surveyed participants' social and demographic information, including gender, education level, marital status, age, and monthly salary income. In terms of clinical characteristics, we investigated the severity of chronic diseases of the participants. The options are "none, consciously healthy", "suffering from one chronic disease", "suffering from two chronic diseases at the same time", and "suffering from more than three chronic diseases at the same time". In addition, we also surveyed participants "whether they currently have anti-pandemic insurance or vaccine insurance" (yes/no), as a reference indicator of people's risk preference.

2.2.2. Attitudes and Beliefs about COVID-19

To measure people's attitudes and beliefs about COVID-19, this study used questions developed by Sherman et al. [13]. Attitudes and beliefs about COVID-19 have two sub-factors. (1) Perceived threat and impact of COVID-19 (6 questions): being worried about catching coronavirus, thinking the coronavirus would be a mild illness for one, too much fuss being made about the risk of coronavirus, being responsible for reducing the spread of coronavirus, immunity to coronavirus, coronavirus pandemic having had a big impact on life; out of which, the second, third, and fifth titles are reverse questions. (2) Trust in management of COVID-19 (2 questions). In this study, the original questions were slightly modified to fit the situation in Taiwan. For example, the original title of "I trust the NHS to manage the coronavirus pandemic in the UK" was changed to "I trust the TCDC to manage the coronavirus pandemic in Taiwan", and "I trust the Government to manage the coronavirus pandemic in the UK" is changed to "I believe the local government where I live can manage and control the coronavirus pandemic in Taiwan." There are 8 items in total.

Responses were rated on a 6-point Likert-type scale, with "1 = Strongly disagree, 2 = Disagree, 3 = Slightly disagree, 4 = Slightly agree, 5 = Agree, 6 = Strongly agree".

The total average score is the score of the corresponding factor. The higher the score, the higher the participant's attitude and belief towards COVID-19.

2.2.3. Information Source

To understand the channels through which the general public will obtain information, we asked "Which channels do you use to obtain information about the COVID-19 pandemic and vaccines". This question is a multiple-choice question, and there is no limit to the number of options. There are a total of 12 options, in the following order: (1) TV news, (2) TV talk shows, (3) CDC press conference, (4) hospital's website, Facebook or LINE, (5) Ministry of Health and Welfare's websites, Facebook or LINE, (6) relatives and friends, (7) the president's Facebook or LINE, (8) the Facebook or LINE of the heads of counties and cities, (9) popular Youtubers' videos, (10) professional medical care personnel's Facebook, LINE or Youtube videos, (11) consultations with familiar medical professionals, (12) others.

2.2.4. Vaccination Decision Intention

To measure the vaccination decision, we asked "When you can have the new coronavirus vaccine, are you willing to get the vaccine?" The options are "Yes", "Not yet decided, still waiting", and "Unwilling".

2.3. Statistical Analyses

All results of quantitative variables were reported either as mean (M), standard deviation (SD), or frequency (percentage %). All results of qualitative variables were reported frequency (percentage %).

The Chi-square independence test was used to determine whether individual factors, such as age group, gender, marital status, education level, monthly salary income, severity of chronic disease, information source, whether currently covered by an anti-pandemic insurance or vaccination insurance, and whether willing to obtain the relevant insurance before vaccination, and other types of variables, are related to the vaccination decision. The Pearson Chi-square test statistics was used for unordered category variables (such as gender, marital status, source of information, whether you are currently insured for pandemic prevention or vaccination, and whether you are willing to obtain the relevant insurance before vaccination). When the Chi-square test was performed on ordered category variables (such as age group, education level, monthly salary income, degree of chronic disease), the M^2 tests were used.

Binary logistic regression was used to analyze the correlation between vaccination decisions and socio-demographic variables, the degree of chronic disease, the current presence or absence of the relevant insurance

(vaccine or pandemic prevention, etc.), attitudes and beliefs about COVID-19, and the type of information source. The odds ratios (ORs) and 95% confidence intervals (CIs) were also calculated, and the significance level was set at 0.05.

In the process of data processing, we first merged the groups in the cross table that have less than 5 or less than 5% of the number of subdivisions. For example, in terms of gender, the number of "neutral/transgender" is less than 5, and the group is included in the "Male" group. In terms of the degree of chronic disease, "having two chronic diseases at the same time" (3.2%) and "having three or more chronic diseases at the same time" (1.2%) are combined into "having two or more chronic diseases at the same time". In terms of vaccination decision-making, only 17 participants (1.53%) expressed "unwillingness", so they were merged into "not yet decided, still waiting" (9.84%).

All statistical analyses were conducted in SPSS version 28 (IBM, Armonk, NY, USA).

3. Result and Discussion

3.1. Descriptive Statistics

A total of 2,950 people visited the online questionnaire, and 1,114 people completed the survey, with a response rate of 37.7%. After excluding the questionnaires with incomplete responses due to the adjustment of questions, 1,108 participants were finally included in the analysis.

Overall, the age of participants ranged from 18 to 78 years, with an average age of 43.19 years (SD=11.096). More than half of the participants were women (58.1%). In addition, 57.9% of the participants were married and 34.2% were single and unmarried. In terms of education level, 61.8% have a university (college) degree, followed by 20.4% with a graduate degree or above. In terms of income, 34.5% of participants' monthly salary income ranged from NT$24,000 to 44,000, followed by below NT$24,000 (22.7%), and between NT$44,000 and 64,000 (21.8%). In terms of clinical characteristics, 77.1% of the participants had no chronic disease or were consciously healthy, followed by 18.5% of the participants who had a chronic disease. In terms of risk preference, we asked participants "whether they currently have a pandemic prevention insurance or vaccine insurance", and only 34.7% answered "yes".

The Attitude and Belief Scale for COVID-19 contained two subscales, namely "Perceived Threat and Impact of COVID-19" and "Trust in Management of COVID-19". In this study, we conducted a reliability analysis on a total of 6 questions on the Perceived Threat and Impact of COVID-19 scale. The analysis showed that the internal consistency coefficient of Cronbach's alpha was 0.675, which is a minimally acceptable reliability [26]. The Trust in Management of COVID-19 scale had 2 questions. The reliability analysis showed that the internal consistency coefficient of Cronbach's alpha is 0.851, which has a very good reliability [26]. The overall reliability of the "Attitude and Belief about COVID-19" was only 0.572, which was too low.

Regarding the six-point scale of attitudes and beliefs about COVID-19, the overall scores of participants ranged from 2-6, with an average of 4.83 (SD=0.607). Overall, the attitudes and beliefs of the people in Taiwan towards COVID-19 during the study period were moderate.

On the question of "which channels to obtain information about the COVID-19 pandemic and vaccines", there were a total of 12 options that can be checked. The total number of times these 12 options were checked by 1,108 participants was 4,266 times. The frequency allocation table is presented in Table 1. Among them, the "Observation Percentage" column was calculated based on the number of times the option was checked divided by the number of valid observations (1,108 people). Among the 12 options, the highest percentage was "TV News", with 75.3% participants getting information about the COVID-19 pandemic and vaccines through exposure to TV news. This is followed by the CDC press conference (65.3%), and in third place is the Ministry of Health and Welfare's website, Facebook or LINE (57.6%). It is worth noting that the percentages of "other" observations.

Finally, in terms of vaccination decisions, among the 1,108 participants, nearly 90% (88.62%) expressed their "willingness" to be vaccinated.

Table 1. Frequency distribution of information source channels

	Times	Percentage of Response	Percentage of Observation
TV news	834	19.5%	75.3%
TV talk shows	292	6.8%	26.4%
CDC Press Conference	724	17.0%	65.3%
Hospital's website, Facebook or LINE	329	7.7%	29.7%
Ministry of Health and Welfare's website, Facebook or LINE	638	15.0%	57.6%
Relatives and friends	321	7.5%	29.0%
President's Facebook or LINE	103	2.4%	9.3%
The heads of counties and cities' Facebook or LINE	174	4.1%	15.7%
General popular Youtuber's video promotion	60	1.4%	5.4%
Facebook, LINE or Youtube videos of medical professionals	399	9.4%	36.0%
Consultation with a familiar medical professional	290	6.8%	26.2%
Others	102	2.4%	9.2%
Total	4266	100.0%	385.0%

3.2. The Relationship between Personal and Clinic Characteristics and Vaccination Decisions

Table 2 presents the results of the Chi-square test analysis, showing that the people's vaccination decision (willing/undecided) was independent of gender, education level, age group, and monthly salary income, while it was related to the degree of chronic disease, whether insured against vaccines or COVID-19, and whether willing to insure before vaccination.

The Chi-square test result cannot demonstrate the strength of the correlation between each of these three factors and vaccination decisions. Therefore, a univariate logistic regression analysis was carried out. The results showed that, compared with the participants who are self-considered healthy, the possibility of vaccination increased by 0.848 times for the participants suffering from a chronic disease. In other words, the chance of winning was reduced by (0.848-1) * 100%=15.2%. Participants suffering from two or more chronic diseases at the same time were 0.407 times more likely to be vaccinated than the participants who are self-considered healthy, which means that the chance of winning was reduced by (0.407-1) * 100%=59.3%. Participants who currently have vaccination or anti-pandemic insurance were 1.73 times more likely to be vaccinated than those who currently have no insurance. Participants who were unwilling to obtain the relevant insurance before vaccination were 0.661 times more likely to be vaccinated than those who were willing to obtain the relevant insurance, which means that the chance of winning was reduced by (0.661-1) * 100% = 33.9%. The aggregated analysis results are presented in Table 3-1.

3.3. The Relationship between Beliefs and Attitudes about COVID-19 and Vaccination Decisions

This study performed univariate logistic regression to analyze the association between beliefs and attitudes towards COVID-19 and vaccination decisions. Table 3-2 presents the analysis results, showing that for every unit of increase in attitudes and beliefs towards COVID-19, the odds of being willing to be vaccinated will increase by 1.702 times.

Table 2. Basic demographic characteristics and clinical status affecting COVID-19 vaccine uptake intention

Variables	Total (n=1108)		Willing (n=982)		Undecided[a] (n=126)		*p*-Value
	n	%	n	%	n	%	
Gender (n=1108)							
Male	464	41.9%	419	42.7%	45	35.7%	0.136
Female	644	58.1%	563	57.3%	81	64.3%	
Education (n=1108)							
High school and below	197	17.8	176	17.9	21	16.7	0.679
College	685	61.8	607	61.8	78	61.9	
Master and above	226	20.4	199	20.3	27	21.4	
Marital status (n=1108)							
Single	379	34.2	335	34.1	44	34.9	0.981
Married	642	57.9	570	58.0	72	57.1	
Others[b]	87	7.9	77	7.8	10	7.9	
Age group (*Mode*=42, *Mean*=43.19, *SD*=11.096, *Range=18-78*) (n=1108)							
18-39	421	38.0	384	39.1	37	29.4	0.122
40-59	592	53.4	513	52.2	79	62.7	
Above 60	95	8.6	85	8.7	10	7.9	
Monthly Income (n=1108)							
Less than NT24,000	251	22.7	215	21.9	36	28.6	0.430
NT24,000~ NT44,000	382	34.5	337	34.3	45	35.7	
NT44,000~ NT64,000	242	21.8	226	23.0	16	12.7	
NT64,000~ NT84,000	115	10.4	103	10.5	12	9.5	
More than NT84,000	118	10.6	101	10.3	17	13.5	
Degree of chronic disease (n=1108)							
Without chronic disease	854	77.1	764	77.8	90	71.4	0.027*
A chronic disease	205	18.5	180	18.3	25	19.8	
Over two chronic diseases simultaneously	49	4.4	38	3.9	11	8.7	
Whether insured against vaccines or COVID-19 (n=1107)							
YES	385	34.8	354	36.1	31	24.6	0.011*
NO	722	65.2	627	63.9	95	75.4	
Whether willing to insure before vaccination (n=1108)							
Willingness	696	62.8	628	64.0	68	54.0	0.029*
Unwillingness	412	37.2	354	36.0	58	46.0	

a Undecided containing 17 "unwilling" participants
b Others include cohabitation/divorced/separated/spouse deceased
*p<0.05 **P<0.01 ***P<.001.

Table 3-1. Univariate logistic regression model of the impact of personal characteristics on vaccination willingness

Estimated Odds Ratio of Willingness to Receive COVID-19 Vaccination					
Variables	B	S.E.	Exp (B)	95% C.I. for Exp (B)	p-Value
Chronic					
None(ref)					
Suffering from a chronic disease	-0.165	0.241	0.848	(0.529 - 1.360)	0.494
Suffering from two or more chronic diseases at the same time	-0.899*	0.360	0.407	(0.201 - 0.824)	0.013
Cox & Snell R^2=0.005; Nagelkerke R^2=0.010; Percent Correct=88.6%					
Insured					
YES vs NO (ref)	0.548*	.217	1.730	(1.130 - 2.649)	0.012
Cox & Snell R^2=0.006; Nagelkerke R^2=0.012; Percent Correct=88.6%					
Unwillingness to insure before vaccination					
YES vs NO (ref)	-0.414*	0.191	0.661	(0.455 - 0.960)	0.030
Cox & Snell R^2=0.004; Nagelkerke R^2=0.008; Percent Correct=88.6%					

*p<0.05, **P<0.01, ***P<.001.

Table 3-2. Univariate logistic regression model of the influence of beliefs and attitudes towards COVID-19 on willingness to vaccinate

Estimated Odds Ratio of Willingness to Receive COVID-19 Vaccination					
Variables	B	S.E.	Exp (B)	95% C.I. for Exp (B)	p-Value
Beliefs and attitudes towards COVID-19	0.532***	0.149	1.702	(1.270-2.281)	<0.001
Cox & Snell R^2=0.011; Nagelkerke R^2=0.022; Percent Correct=88.6%					

*p<0.05 **P<0.01 ***P<.001.

Table 4. Information type affecting COVID-19 vaccine uptake intention

Variables	Total (n=1108)		Willing (n=982)		Undecided (n=126)		*p*-Value
	n	%	n	%	n	%	
TV news							
NO (0)	274	24.7%	244	24.8%	30	23.8%	0.799
YES (1)	834	75.3%	738	75.2%	96	76.2%	
TV talk show							
NO (0)	816	73.6%	728	74.1%	88	69.8%	0.303
YES (1)	292	26.4%	254	25.9%	38	30.2%	
CDC Press Conference							
NO (0)	384	34.7%	324	33.0%	60	47.6%	0.001***
YES (1)	724	65.3%	658	67.0%	66	52.4%	
Hospital's website, Facebook or LINE							
NO (0)	779	70.3%	688	70.1%	91	72.2%	0.617
YES (1)	329	29.7%	294	29.9%	35	27.8%	
Ministry of Health and Welfare's website, Facebook or LINE							
NO (0)	470	42.4%	404	41.4%	66	52.4%	0.016*
YES (1)	638	57.6%	578	58.9%	60	47.6%	
Relatives and friends							
NO (0)	787	71.0%	703	71.6%	84	66.7%	0.252
YES (1)	321	29.0%	279	28.4%	42	33.3%	
President's Facebook or LINE							
NO (0)	1005	90.7%	884	90.0%	121	96.0%	0.029*
YES (1)	103	9.3%	98	10.0%	5	4.0%	
Facebook or LINE of the heads of counties and cities							
NO (0)	934	84.3%	817	83.2%	117	92.9%	0.005**
YES (1)	174	15.7%	165	16.8%	9	7.1%	
Popular Youtubers' video promotion							
NO (0)	1048	94.6%	930	94.7%	118	93.7%	0.623
YES (1)	60	5.4%	52	5.3%	8	6.3%	
Facebook, LINE or Youtube videos of medical professionals							
NO (0)	709	64.0%	620	63.1%	89	70.6%	0.099
YES (1)	399	36.0%	362	36.9%	37	29.4%	
Consultation with a familiar medical professional							
NO (0)	818	73.8%	726	73.9%	92	73.0%	0.826
YES (1)	290	26.2%	256	26.1%	34	27.0%	
Others							
NO (0)	1006	90.8%	902	91.9%	104	82.5%	0.001***
YES (1)	102	9.2%	80	8.1%	22	17.5%	

*p<0.05, **P<0.01, ***P<.001.

3.4. The Link between the Type of Information and Vaccination Decisions

Whether the information type of the Chi-square independence test is related to the vaccination decision is shown in Table 4, showing that there are four sources of information related to the vaccination decision, i.e., "The Press Conference of the CDC" and "Ministry of Health and Welfare's Website, Facebook or LINE", "President's Facebook or LINE", "Facebook or LINE of the heads of counties and cities".

In this study, the four sources of information were subjected to univariate logistic regression analysis to explore the strength of the correlation between each of these four sources of information and vaccination decisions. The results of the analysis showed that given Other information unchanged, for every additional unit of information in the CDC's press conference, its odds ratio increased by 1.846 times, and there is a statistically significant difference.

With other explanatory variables unchanged, for every additional unit of information from the Ministry of Health and Welfare, the odds of being willing to be vaccinated increased by 1.574 times compared with other sources of information. For every additional unit of information from the President's Facebook or LINE, the odds of being willing to be vaccinated increased by 2.683 times compared with other sources of information. For every additional unit of information from the Facebook or LINE of the heads of counties and cities, the odds of being willing to be vaccinated increased by 2.625 times compared with other sources of information.

Table 5. Univariate Logistic Regression Model of the Impact of Information Source Type on Vaccination Willingness

Estimated Odds Ratio of Willingness to Receive COVID-19 Vaccination					
Variables	B	S.E.	Exp (B)	95% C.I. for Exp (B)	p-Value
CDC Press Conference					
YES vs NO (ref)	0.613***	0.191	1.846	(1.270 - 2.684)	0.001
Cox & Snell R^2=0.009; Nagelkerke R^2=0.018; Percent Correct=88.6%					
Ministry of Health and Welfare's website, Facebook or LINE					
YES vs NO (ref)	0.453*	0.190	1.574	(1.085 - 2.283)	0.017
Cox & Snell R^2=0.006; Nagelkerke R^2=0.012; Percent Correct=88.6%					
President's Facebook or LINE					
YES vs NO (ref)	0.987*	.469	2.683	(1.071 - 6.722	0.035
Cox & Snell R^2=0.005; Nagelkerke R^2=0.010; Percent Correct=88.6%					
Facebook or LINE of the heads of counties and cities					
YES vs NO (ref)	0.965**	0.356	2.625	(1.306 - 5.278)	0.007
Cox & Snell R^2=0.008; Nagelkerke R^2=0.017; Percent Correct=88.6%					

*p<0.05, **P<0.01, ***P<.001.

3.5. Multiple Logistic Regression Model

This study used the significant variables to explain the dependent variable, that is, the people's vaccination decision-making, and sought to establish a multiple logistic regression model. The model selection process is presented in Table 6. First of all, the independent variables included "Attitudes and Beliefs about COVID19", the degree of chronic disease, and whether there is relevant insurance at present, and all variables were significant (see Model 2). In addition, because the information source type is a multiple-choice question and the options are not mutually exclusive (see Model 4-6), they are individually put into the model, leaving statistically significant explanatory variables. Finally, the best multivariate logistic models are Model 3 and Model 7.

The logistic regression of Model 3 is

$$\hat{Y} = \frac{1}{1+e^{-(\beta_0+\beta_1 X_{1i}+\beta_2 X_{2i}+\beta_3 X_{3i}+.....+\beta_k X_{ki})}}$$

$$\ln\left(\frac{P_{willingness}}{1-P_{willingness}}\right) = -0.550 + 0.481 \times \ln\text{"Attitudes and Beliefs about COVID19"} - 0.922 \times (\text{chronic} = 3) + 0.497 \times (\text{Insured} = 1) + 0.431 \times (\text{CDC press conference} = 1)$$

The above regression equation can be explained as follows. After controlling the source of information, the presence or absence of relevant insurance, and the degree of chronic disease, for every unit of increase in the score of attitude and belief towards COVID-19, the odds of being willing to be vaccinated were 1.618 times, which is statistically significant (p<0.01).

After controlling the attitudes and beliefs about COVID-19, the source of information, and the availability of relevant insurance, for participants who suffer from two or more chronic diseases at the same time, the odds of being willing to be vaccinated were 0.398 times, which is statistically significant (p<0.05).

After controlling the attitudes and beliefs about COVID-19, the degree of chronic disease, and the sources of information, participants with vaccination or anti-pandemic insurance were 1.644 times more likely to be vaccinated than other participants, which is statistically significant (p <0.05).

After controlling the attitudes and beliefs about COVID-19, the degree of chronic disease, and the availability of relevant insurance, participants who came into contact with the CDC press conference were 1.539 times more likely to be vaccinated than those who were exposed to other types of information, which is statistically significant (p<0.05).

In the same way, the regression coefficients of the Facebook or LINE of heads of counties and cities in

Model 7 are explained as follows. After controlling the attitude and belief about COVID-19, the degree of chronic disease, and whether they have the relevant insurance, for participants who viewed the heads of counties and cities' Facebook or LINE, the odds of being willing to be vaccinated were 2.401 times more than those who were exposed to other types of information, which is statistically significant ($p<0.05$).

Table 6.

Estimated Odds Ratio of Willingness to Receive COVID-19 Vaccination						
Model	Variables	B	S.E.	Exp (B)	95% C.I. for Exp (B)	p-Value
M1	Attitudes and beliefs about COVID-19	0.564***	0.151	1.758	(1.308 - 2.363)	0.000
	None (ref)					
	Suffer from a chronic disease	-0.215	0.243	0.806	(0.501 - 1.297)	0.375
	Suffering from two or more chronic diseases at the same time	-1.010**	0.365	0.364	(0.178 - 0.746)	0.006
	Constant	-0.525	0.707	0.591		0.458
	Cox & Snell R^2=0.017; Nagelkerke R^2=0.034; Percent Correct=88.6%; H-L test value=7.656 (p-value=0.468 >0.05)					
M2	Attitudes and beliefs about COVID19	0.549***	0.151	1.732	(1.287 - 2.329)	0.000
	None (ref)					
	Suffer from a chronic disease	-0.225	0.243	0.799	(0.495 - 1.287)	0.355
	Suffering from two or more chronic diseases at the same	-1.003**	0.368	0.367	(0.178 - 0.754)	0.006
	Is there any relevant insurance at present (YES)	0.523*	0.219	1.686	(1.098 - 2.591)	0.017
	Constant	-0.610	0.71	0.543		0.39
	Cox & Snell R^2=0.023; Nagelkerke R^2=0.045; Percent Correct=88.6%; H-L test value =6.979 (p-value=0.539 >0.05)					
M3	Attitudes and beliefs about COVID19	0.481**	0.155	1.618	(1.194 - 2.191)	0.002
	None (ref)					0.043
	Suffer from a chronic disease	-0.185	0.245	0.831	(0.514 - 1.342)	0.449
	Suffering from two or more chronic diseases at the same	-0.922*	0.371	0.398	(0.192 - 0.823)	0.013
	Is there any relevant insurance at present (YES)	0.497*	0.220	1.644	(1.068 - 2.528)	0.024
	CDC Press Conference (YES)	0.431*	0.198	1.539	(1.044 - 2.269)	0.030
	Constant	-0.550	0.713	0.577		0.441
	Cox & Snell R^2=0.027; Nagelkerke R^2=0.053; Percent Correct=88.6%; H-L test value =4.944 (p-value=0.764 >0.05)					
M4	Attitudes and beliefs about COVID-19	0.463**	0.156	1.588	(1.170 - 2.156)	0.003
	None (ref)					0.046
	Suffer from a chronic disease	-0.184	0.245	.832	(0.515 - 1.345)	0.454
	Suffering from two or more chronic diseases at the same time	-0.916*	0.373	.400	(0.193 - 0.831)	0.014
	Is there any relevant insurance at present (YES)	0.497*	0.220	1.644	(1.069 - 2.530)	0.024
	CDC Press Conference (YES)	0.368	0.203	1.445	(0.971 - 2.151)	0.070
	Ministry of Health and Welfare's website, Facebook or LINE (YES)	0.285	0.198	1.330	(0.901 - 1.962)	0.151
	Constant	-0.578	0.717	0.561		0.420
	Cox & Snell R^2=0.029; Nagelkerke R^2=0.056; Percent Correct=88.6%; H-L test value=4.030 (p-value=0.854 >0.05)					
M5	Attitudes and beliefs about COVID-19	0.465**	0.155	1.592	(1.175 - 2.157)	0.003
	None (ref)					0.044
	Suffer from a chronic disease	-0.169	0.245	0.844	(0.522 - 1.365)	0.490
	Suffering from two or more chronic diseases at the same	-0.925*	0.373	0.397	(0.191 - 0.823)	0.013
	Is there any relevant insurance at present (YES)	0.507*	0.220	1.661	(1.079 - 2.556)	0.021
	CDC Press Conference (YES)	0.372	0.200	1.451	(0.980 - 2.146)	0.063
	President's Facebook or LINE (YES)	0.772	0.477	2.164	(0.850 - 5.509)	0.105
	Constant	-0.495	0.715	0.610		0.489
	Cox & Snell R^2=0.03; Nagelkerke R^2=0.058; Percent Correct=88.6%; H-L test value=6.854 (p-value=0.552 >0.05)					
M6	Attitudes and beliefs about COVID-19	0.457**	0.155	1.579	(1.164 - 2.141)	0.003
	None (ref)					0.045
	Suffer from a chronic disease	-0.161	0.245	0.851	(0.526 - 1.376)	0.511
	Suffering from two or more chronic diseases at the same	-0.922*	0.373	0.398	(0.192 - 0.825)	0.013
	Is there any relevant insurance at present (YES)	0.513*	0.220	1.671	(1.085 - 2.572)	0.020
	CDC Press Conference (YES)	0.366	0.199	1.441	(0.976 - 2.129)	0.066
	Facebook or LINE (YES) of the heads of counties and cities (YES)	0.806*	0.362	2.240	(1.101 - 4.556)	0.026
	Constant	-0.496	0.717	0.609		0.490
	Cox & Snell R^2=0.032; Nagelkerke R^2=0.06; Percent Correct=88.6%; H-L test value =11.476 (p-value=0.175 >0.05)					
M7	Attitudes and beliefs about COVID-19	0.510***	0.152	1.665	(1.235 - 2.245)	0.001
	None (ref)					0.027
	Suffer from a chronic disease	-0.191	0.244	.826	(0.512 - 1.333)	0.433
	Suffering from two or more chronic diseases at the same	-0.984**	0.370	.374	(0.181 - 0.771)	0.008
	Is there any relevant insurance at present (YES)	0.535*	0.220	1.708	(1.111 - 2.627)	0.015
	Facebook or LINE (YES) of the heads of counties and cities (YES)	0.876*	0.360	2.401	(1.186 - 4.859)	0.015
	Constant	-0.533	0.715	.587		0.456
	Cox & Snell R^2=0.029; Nagelkerke R^2=0.057; Percent Correct=88.6%; H-L test value =8.046 (p-value=0.429 >0.05)					

*p<0.05, **P<0.01, ***P<.001.

4. Discussion

This study has two purposes. The first is to understand the acceptance of the COVID-19 vaccine by the Taiwanese people during the Level 3 alert period when two vaccines were available, and to try to explore possible influencing factors. The second is to assess the impact of the source of information on the public's acceptance of the COVID-19 vaccine.

As far as we know, there is only one study in Taiwan that explores the public's acceptance of the COVID-19 vaccine [15]. The results show that only 52.7% of the participants in Taiwan are willing to receive the COVID-19 vaccine. It is lower than other high-income countries, such as France and Sweden, and the low acceptance is mainly due to the impact of past vaccination experience. However, the samples collected in this study through online questionnaires show that the public's acceptance of vaccines has changed significantly. During the Level 3 alert period from June 30 to July 30, 2021, the rate of people willing to be vaccinated was 88.62%, which was much higher than the acceptance level during the Level 2 alert period in October 2020 [15]. In addition, the results of this study show that the two categories of "willing and not yet determined to receive COVID-19 vaccine" have nothing to do with gender, education level, marital status, and age, and are different from the results of previous studies in Taiwan [15]. This phenomenon may be caused by the rapid increase in the number of infections in Taiwan during the study period (Taiwan Centers for Disease Control). We speculate that the possible reason for this phenomenon is that when people perceive the pandemic to be relatively serious, personal health protection behaviors (washing hands, wearing masks, and maintaining social distancing) may not be able to cope with COVID-19, so they will increase acceptance of the vaccine against COVID-19, even though these vaccines may have strong side effects on certain ethnic groups [27].

This study found that chronic disease groups that are sensitive to health-related issues are less willing to be vaccinated than healthy groups. The chance of participants suffering from one chronic disease of being vaccinated was 15.2% lower, and the chance of participants suffering from two or more chronic diseases at the same time of being vaccinated was 59.3% lower. Because the available COVID-19 vaccine is relatively new, there is a high degree of uncertainty about possible side effects. This is consistent with past research [15].

Regarding the types of information channels, we have provided 11 options and found that the type of information channels through which people obtain information about vaccines or the pandemic is related to their willingness to vaccinate, especially channels from official sources, such as the CDC press conference, which is broadcast live online at 2 o'clock in the afternoon every day, the information published by the heads of counties and cities that actually provide the vaccination on the official Facebook or official LINE, as well as the website of the Ministry of Health and Welfare and the President's Facebook. With the control and other conditions remaining unchanged, contact with information from the CDC press conference and county and city chiefs caused the odds of vaccination to increase by 1.539 times and 2.401 times, respectively, which reaches statistical significance. We believe that this research result implies two important conclusions. First, although the time cost of holding a press conference every day is quite high, responding to the public's doubts and eliminating wrong information in real time will help increase the willingness of vaccination. Second, the information dissemination process also builds public trust in the government, which echoes the research results and arguments of the past that "popular trust in the government is the key to vaccine acceptance" [11,17,28]. In addition, the twelfth option "other types of information" is significantly related to vaccination decisions, showing that personal decision-making is deeply influenced by various media or information channels. Further exploration is required for what other types of media information make decisions for the public, and what is the path of influence.

5. Limitation

This study has several limitations. First, although the use of online questionnaires as a survey tool breaks the limitations of time and space, it is still difficult for the elderly to complete the online questionnaires on the vehicle, so the proportion of our elderly participants is relatively low. Second, the total population of Taiwan in May of the Republic of China was 23,499,070, with 11,640,336 males (49.54%) and 11,858,734 females (50.46%). The results of the Chi-square fitness test show that the gender ratio of the sample is significantly different from the gender ratio of the population. Therefore, it is not suitable to make general statistical inferences from the sample. Third, due to the method of data collection, we may not be able to rule out reporting bias.

6. Conclusion

Our research results show that during the Level 3 alert period, Taiwan's vaccine acceptance is relatively high. Age, education level, and gender have nothing to do with the acceptance of the COVID-19 vaccine. The higher the degree of chronic disease, the less willing to receive the COVID-19 vaccine. Participants who currently have vaccine-related insurance are more willing to receive the COVID-19 vaccine. In addition, participants who are exposed to official information are more likely to receive the vaccine. We recommend that researchers conduct an in-depth investigation into the considerations of specific ethnic groups who refuse to receive the COVID-19 vaccine, and continue to use the CDC's press conference, and the official Facebook or LINE of the heads of counties and cities as tools for pandemic prevention policy marketing.

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