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RESEARCH PAPER

Impact of a community-based health education intervention on awareness of influenza, pneumonia, and vaccination intention in chronic patients

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ABSTRACT

The study aimed to examine the impact of a community-based health education intervention on the awareness and attitude of influenza and *Streptococcus pneumoniae* vaccination in patients with chronic diseases. We selected study participants from two counties in Jiaxing City, Zhejiang Province. We conducted a household baseline survey with quarterly follow-up and health education for all chronic disease patients in the area. A total of 720 patients with chronic diseases were included in two rounds of questionnaire surveys before and after a year-long health education related to the influenza and *Streptococcus pneumoniae* vaccination. Before the community education, 59.9% and 59.6% of study participants self-report the awareness of the hazards of influenza and pneumonia, respectively; while only 17.7% and 6.0% study participants self-reported awareness of the influenza or pneumonia vaccination, respectively; the self-reported vaccination rates were 1.3% and 0% for influenza and pneumonia, respectively. One year after the intervention, all rates were increased significantly, but the influenza vaccination rate was still far below the WHO minimum target level (75%). The main reason for not getting vaccinated reported by study participants was that participants thought they were in good health and would not become sick easily. There was no statistically significant difference between the impacts of health care practitioners' and general practitioners' recommendations for vaccination. Continued and pertinent health education has a significant impact on influenza and pneumonia vaccination in patients with chronic diseases.

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Introduction

Influenza and pneumonia can affect people of all ages, and their effects are especially considerable for people with existing chronic diseases such as cardiovascular diseases and diabetes mellitus.[1] Noncommunicable diseases (NCDs) are the leading cause of death worldwide. The four main noncommunicable diseases, namely, cardiovascular disease, cancer, chronic lung diseases and diabetes, kill three in five people worldwide. More than 36 million people die of NCDs each year, accounting for 63% of the global death toll. NCDs have also become the main cause of death in China, and the trend is still on the rise.[2] Chronic disease patients are highly susceptible to infections due to their weakened immune systems. Moreover, unlike self-limiting in healthy people, influenza, and pneumonia generally results in more serious consequences and requires medical treatment in chronic disease patients.[3] The number of influenza and pneumonia cases varies widely from year to year, but the relevant morbidity and mortality are significantly increased during epidemic seasons in elderly chronic disease patients almost every year.[1]

Estimates of the burden of disease among high-risk populations are important for developing effective vaccination strategies, preventive measures, and clinical treatments that prevent these populations from becoming infected with influenza and pneumonia.[4] The United States (US) Centers for Disease Control and Prevention (CDC) reported that influenza-associated deaths among all age groups with existing respiratory and circulatory conditions (including pneumonia and influenza infection) ranged from 3,349 to 48,614 and the annual rate of influenza-associated death ranged from 1.4 to 16.7 deaths per 100,000 persons during the seasonal influenza periods between 1976 and 2007, while the majority (89.4% on average) of deaths occurred in elderly individuals over 65 years old. Among elderly individuals (adults aged ≥65 years), the estimated influenza-associated deaths among those with underlying respiratory and circulatory conditions ranged from 2,344 to 43,727 annually, while deaths attributable solely to pneumonia or influenza were in the range of 673 to 13,245 annually.[5] In China, 249 million people (11.9% of the nation's population) were aged 60 years or older in 2018, an indication that more than 180 million elderly people suffered from chronic diseases in 2018, and this number is expected to increase to 329 million (26%) in 2050. An investigation conducted in 2003 and 2008 in China reported that 86% of influenza-associated excess mortality was thought to be associated with people over 65 years old and those who have a high prevalence of chronic diseases.[6]

Multiple studies have shown that vaccination for influenza and pneumonia could reduce the related hospitalizations and

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all-cause mortality of chronic disease patients.[1,3,7,8] The World Health Organization (WHO) recommends the use of inactivated vaccines to prevent seasonal influenza among chronic disease patients and older people.[2] The data published by the WHO showed that influenza vaccination can reduce hospitalization by 25%–39% and the total mortality of home-living elderly individuals by 39%–75% and better immunization effectiveness (50% hospitalization and 68% mortality risk) was found among those who were living in nursing institutions during the influenza season. At present, vaccination is stated to be one of the most cost-effective interventions for influenza and pneumonia control among high-risk people. However, the vaccination rates for influenza and pneumonia among Chinese people were found to be lower than those among people in developed countries.

In China, most adult vaccines including influenza and pneumonia vaccines are not freely available. These self-paid vaccines are known as category 2 vaccines. People are vaccinated at community hospitals. Although influenza and pneumonia vaccines are free for some special populations in a few regions of China, such as Beijing and Shanghai, the vaccines are category 2 vaccines that are not free for the public, and in most areas of China, residents can choose whether to be inoculated.[9] Prior to the implementation of a large-scale vaccination policy, it is important to know the target population's knowledge, willingness, and relevant behavior regarding vaccination for influenza and pneumonia as a means of medical intervention. For this reason, we conducted a survey from February 2016 through May 2017 in China, and the survey participants represented a large population with diverse demographic, socioeconomics, and social classes in the general Zhejiang population. Through a two-round survey of the health education program, our study hopes to find out the key factors affecting vaccination, such as publicity, free policy, and recommendations by doctors. The survey results can help governmental agencies (e.g., regional CDCs) understand chronic disease patients' perceptions of and attitudes toward receiving influenza and pneumonia vaccines, thereby allowing them to design appropriate health intervention plans.

Materials and methods

Study sites

Two rounds of a perception survey were carried out in Tongxiang County, Zhejiang Province, including two townships or neighborhood communities, and Haining County, Zhejiang Province including three townships or neighborhood communities. Both Tongxiang and Haining are large counties that include a large population of Zhejiang province with diverse demographics, income levels, and living classes and both of them are national demonstration areas for the comprehensive prevention and control of noncommunicable diseases.

Study participants

All chronic disease patients (aged between 14 and 75) incorporated into chronic disease management system in Tongxiang and Haining were included in the study. The full name of chronic disease is chronic non-communicable disease, which is a general term for a kind of disease with insidious onset, long course, and hard to recover. This kind of disease lacks clear evidence of infectious biological etiology, and its etiology is complicated or has not been completely confirmed. It results from a series of changes at an infectious biological level. The etiology of this kind of disease still remains unknown. In general, chronic diseases mainly refer to cardiovascular and cerebrovascular diseases, malignant tumors, diabetes, and chronic respiratory diseases. The cardiovascular and cerebrovascular diseases include hypertension, stroke, and coronary heart disease. The chronic disease management system mainly includes patients with hypertension or diabetes.

Sampling method

A total of 20,766 chronic disease patients in the study area was selected from the Chronic Surveillance Information System of Zhejiang Province. Then, the researchers encoded and ranked the identification number for patients in each county. The parameters for the sample size calculation were as follows: The expected difference between the two-round survey was 5% and the power of the sample was 80%. Based on the assumption of a 20% missing rate, 720 participants (360 from each county) were needed to complete the questionnaires on cognition of related diseases and willingness to vaccinate. A systematic sampling method with 28 sampling intervals (20,000 divided by 720 is 27, with a remainder of 560) was used. Two rounds of intention survey were sampled from the entire population, respectively. The first round of the survey was conducted in 2016, and the second round was launched 1 year later. Multiple rounds of health education and media publicity were conducted within this year.

Survey methods

The study began on May 1, 2015, the observation period of the entire population was from June 2015 to May 2018, and the observation period of the two rounds of intention survey were in February 2016 and May 2017, respectively. Vaccination of participants was collected by the general practitioner through the vaccination information platform during the study period. Home-visit was made with questionnaires by trained community doctors. Participants needed to fill in three kinds of questionnaires: basic information questionnaires were completed when the study started; follow-up questionnaires were filled out quarterly; and cognition questionnaires were collected before and after intervention. It should be noted that the first two kinds of questionnaire were for all participants (20,766 chronic disease patients). The survey on cognition was conducted with all 720 sampled participants. For the cognition questionnaires, willingness to receive vaccines, reasons for not being immunized, and the effect of different practitioners' recommendations on immunization were only investigated in patients who knew about the influenza and pneumonia vaccines but had not received them.

In this study, we mainly analyzed cognition questionnaires, but personal information including insurance survey was from basic information questionnaires through identity matching.

Questionnaire development and validation

The preparation of our questionnaire was informed by Knowledge Attitude Practice (KAP) studies and based on the theory of planned behavior (Ajzen, 1991). The questionnaire was developed following a standardized protocol that incorporated literature review and our profound experience in epidemiology survey. In addition, after we designed the questionnaire, we conducted a survey on 100 individuals to validate this questionnaire. The final questionnaire consisted of four domains and a total of 42 questions, Exploratory factor analysis was performed, using principal components with varimax rotation, to establish the construct validity of the questionnaire. The internal consistency of the questionnaire was tested using Cronbach's α coefficient.

Quality control

The validated data collection was piloted to experts with both clinical and research background. Unified questionnaire and face-to-face survey were used to ensure the consistency and accuracy of the data. Each questionnaire was completed by two investigators. One is responsible for filling in the questionnaire and the other are responsible for reviewing the questionnaire. The researchers checked the questionnaires by random inspection and telephone follow-up. The questionnaire was kept by a special person, and the data was entered using double independent entry.

Statistical analysis

The database was established in Epi Info 3.0 software. Categorical variables are presented as counts and percentages. Two-sided Pearson's chi-squared or Fisher's exact tests were used to compare categorical data. The Mann-Whitney U-test was used to compare ordinal data. All analyses were performed using IBM SPSS Statistics version 20 (IBM Corp., Armonk, NY, USA), with the statistical significance set at $p< .05$.

Ethics statement

The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Ethics Committee of the Zhejiang Provincial Center for Disease Control and Prevention (protocol code 2015–019). Written informed consent for participation was obtained from all participants before the study.

Results

Demographic characteristics and medical insurance situations

The study began on May 1, 2015, and a total of 20,766 patients with chronic diseases were eligible for survey. Gender and age were evenly distributed across the different regions. The participants were mostly older than 50, and the gender ratio was nearly 1:1. For each round of the intention survey, 720 participants were sampled. The first round of the survey was completed in February 2016. A total of 358 chronic disease patients in Tongxiang and an equal number of patients in Haining completed the survey. The response rate was 99.44%. The second round of the survey was completed in May 2017. A total of 331 valid questionnaires were received in Tongxiang, and 356 were received in Haining. The response rate was 95.42%. The demographic information is shown in Table 1

The medical insurance survey showed that 43.0%, 31.6%, and 31.6% of the sample had the new rural cooperative medical system, urban residents' medical insurance, and urban workers' medical insurance, respectively.

Health education intervention

Since the project began in early 2016, health education has been carried out regularly for all chronic disease patients in the study areas to improve their cognition.

Various forms of activities were provided to improve awareness of preventive inoculation in Tongxiang, such as distributing more than 10,000 posters and leaflets, sending information via WeChat once a month, advocating inoculation through television and newspaper media once a month, and designing other propaganda materials.

Table 1. Demographics of participants in the survey.

	Study population (N = 20766)		Target population of the first round (n = 716)		Target population of the second round (n = 687)	
Characteristics	Haining City (n = 10012)	Tongxiang City (n = 10754)	Haining City (n = 358)	Tongxiang City (n = 358)	Haining City (n = 356)	Tongxiang City (n = 331)
Gender (n(%))						
Male	5245(52.4)	5302(49.3)	207(57.8)	185(51.7)	182(51.1)	175(52.9)
Female	4750(47.4)	5451(50.7)	151(42.2)	173(48.3)	174(48.9)	156(47.1)
Missing	17(0.2)	1(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
Age (year, n(%))						
<30	25(0.2)	8(0.1)	0(0.0)	0(0.0)	1(0.3)	0(0.0)
30-	162(1.6)	100(0.9)	4(1.1)	5(1.4)	4(1.1)	0(0.0)
				29		
40-	1258(12.6)	1061(9.9)	40(11.2)	29(8.1)	49(13.8)	32(9.7)
50-	3262(32.6)	3236(30.1)	120(33.5)	93(26.0)	117(32.9)	94(28.4)
60-	3936(39.3)	4568(42.5)	141(39.4)	162(45.3	139(39.0)	148(44.7)
70-	1369(13.7)	1781(16.6)	53(14.8)	69(19.3)	46(12.9)	56(16.9)

Various forms of propaganda were also carried out in Haining, such as 43 organizing public lectures, handing out 11,000 brochures, putting up 350 posters, and pushing information four times via WeChat and being browsed by 4,213 person-time.

Among the two counties, vaccination was recommended for all patients with chronic diseases under management by local health practitioners during follow-up.

Awareness of influenza and pneumonia and their corresponding vaccines

In the first round of the survey, a total of 716 patients participated in the investigation. The awareness rates of influenza and pneumonia diseases were 59.9% and 59.6%, respectively, and the difference in awareness between the two diseases was not statistically significant (χ^2 = 0.01, *P*= .91). The awareness rates of influenza and pneumonia vaccination were 17.7% and 6.0%, respectively, and the difference in awareness was statistically significant (χ^2 = 47.10, *P*= .00) (Table 2). Nine patients had received influenza vaccines, accounting for only 1.26% of the total sample, and none had received the pneumonia vaccine.

In the second round of the survey, a total of 687 patients participated. The awareness rates of influenza and pneumonia rose to 70.5% and 73.9%, respectively, and the difference in awareness between the two diseases was not statistically significant (χ^2 = 2.09, *P*= .15). Similarly, the awareness rates of influenza and pneumonia vaccination also showed a significant increase, reaching 43.8% and 36.8%, respectively, and the difference in awareness was statistically significant (χ^2 = 6.97, *P*= .01) (Table 2). Sixteen patients had received the influenza vaccine, while 10 patie nts had received the pneumonia vaccine.

Willingness to receive the influenza and pneumonia vaccines

In February 2016, only 0.8% of the participants said they would definitely receive the influenza vaccine, 12.7% said they would probably receive it and 40.7% said they would make a decision depending on the situation, while 4.7% of the participants said they would definitely receive the pneumonia vaccine and,7.0% said they would probably receive it and 18.6% said they would decide based on the situation. The possibility of vaccination was higher for the influenza vaccine than for the pneumonia vaccine, and the difference was statistically significant (Z = −2.31, *P* = .02).

A year after the education program was conducted, in May 2017, the overall willingness to be vaccinated increased among study participants. A total of 4.9% of the participants said they would definitely receive the influenza vaccine, 17.2% said they would probably receive it and 49.1% said it depended, while 5.8% of the participants said they would definitely receive the pneumonia vaccine, 29.2% said they would probably receive it and 47.8% said it depended. The possibility of vaccination was higher for the pneumonia vaccine than for the influenza vaccine, and the difference was statistically significant (Z = −4.26, *P*< .01)(Table 3).

Table 2. Awareness of influenza and pneumonia and their corresponding vaccines.

	First round (n = 716)			Second round (n = 687)		
	No	Yes	Awareness rate	No	Yes	Awareness rate
Influenza	287	429	59.9%	203	484	70.5%
Influenza vaccine	589	127	17.7%	386	301	43.8%
Pneumonia	289	427	59.6%	179	508	73.9%
Pneumonia vaccine	673	43	6.0%	434	253	36.8%

Reasons for not being immunized

In the first round of the survey, the most frequent reasons for not receiving the influenza vaccine included a belief that one is unlikely to be infected with influenza (67.8%), a lack of a recommendation for vaccination (6.8%), and a lack of confidence that vaccinations are effective for influenza (6.8%). The main reasons for not receiving the pneumonia vaccine included a belief that one is unlikely to be infected with pneumonia (69.8%), a lack of recommendation for vaccination (9.3%), and a lack of confidence that vaccinations are effective for pneumonia (7.0%) (Table 4).

In the second round of the survey, the most frequent reasons for not receiving the influenza vaccine included a belief that one is unlikely to be infected with influenza (74.4%), a lack of recommendation of vaccination (4.9%), and a lack of knowledge of when to vaccinate (4.2%). The main reasons for not receiving the pneumonia vaccine included a belief that one is unlikely to be infected with pneumonia (77.4%), a lack of recommendation of vaccination (5.3%), and a lack of knowledge of when to vaccinate (4.1%) (Table 4).

The two survey rounds showed that more than 70% of the patients did not receive vaccines because they believed themselves to be unlikely to be infected with influenza or pneumonia.

Effect of different practitioners' recommendations on immunization

At the start of the study, the acceptance rates of vaccination recommendations from both health care practitioners and general practitioners were relatively low. The difference in acceptance between recommendations from different types of practitioners was not statistically significant for influenza (z = −0.08, *p* = .94) or pneumonia (z = −0.86, *p* = .39) (Table 5).

A year after the project, the acceptance rates were improved but were still at a relatively low level. The difference in acceptance between recommendations from different types of practitioners was still not statistically significant for influenza (z = −0.99, *p* = .32) or pneumonia (z = −0.50, *p* = .62) (Table 5).

Change in vaccination rates from before to after the intervention

Of all participants in the study, a total of 78 participants had received the influenza vaccine, and none received the pneumococcal vaccine before the study started. During the study period from June 2015 to May 2018, 711 participants in Haining and 1,258 participants in Tongxiang received the influenza or pneumococcal vaccine. The total inoculation rates improved greatly, and the improvement was statistically significant

Table 3. Willingness of the study population to receive the influenza and pneumonia vaccines.

	First round						Second round					
	Influenza		Pneumonia				Influenza		Pneumonia			
Question	n = 118	%	n = 43	%	Z/χ^2	*P value*	n = 285	%	n = 243	%	Z/χ^2	*P* value
Possibility of vaccination					−2.31	.02[a]					−4.26	.00[a]
Definitely	1	0.8	2	4.7			14	4.9	14	5.8		
Probably	15	12.7	3	7.0			49	17.2	71	29.2		
It depends	48	40.7	8	18.6			140	49.1	121	49.8		
Probably not	40	33.9	21	48.8			58	20.4	32	13.2		
Definitely not	14	11.6	9	20.9			24	8.4	5	2.1		
Who needs the flu/pneumonia vaccine most (multiple choice)												
People with poor health	65	55.1	26	60.5	0.37	.54[b]	186	65.3	167	68.7	0.71	.40 [b]
Children	46	39.0	17	39.5	0.00	.95[b]	138	48.4	130	53.5	1.35	.25 [b]
People who easily contract a cold	64	54.2	14	32.6	5.93	.02[b]	145	50.9	98	40.3	5.87	.02 [b]
Elderly people	49	41.5	21	48.8	0.69	.41[b]	73	25.6	64	26.3	0.04	.85 [b]
Chronic disease patients	9	7.6	8	18.6		.08 [c]	25	8.8	25	10.3	0.35	.55 [b]
Others	3	2.5	0	0.0		.57 [c]	3	1.1	2	0.8		1.00 [c]

[a]Mann–Whitney U test; [b]chi-square test; [c]Fisher's exact test.

Table 4. Reasons for not having the influenza or pneumonia vaccination.

	First round		Second round	
Reasons	Influenza 118(%)	Pneumonia 43(%)	Influenza 285(%)	Pneumonia 243(%)
Belief that one is unlikely to be infected with influenza or pneumonia	80(67.8)	30(69.8)	212(74.4)	188(77.4)
Potential for allergic reaction	2(1.7)	1(2.3)	3(1.1)	7(2.9)
Concerns about adverse reactions that might occur with vaccination	1(0.8)	0(0.0)	4(1.4)	4(1.6)
Lack of confidence that vaccinations are effective for the common cold or pneumonia	1(0.8)	3(7.0)	9(3.2)	7(2.9)
Lack of confidence that vaccinations are effective for influenza	8(6.8)	-	9(3.2)	-
Experience with friends being vaccinated but the vaccine not seeming to be effective	1(0.8)	2(4.7)	3(1.1)	1(0.4)
Lack of knowledge of when to vaccinate	5(4.2)	2(4.7)	12(4.2)	10(4.1)
Lack of recommendation of vaccination	8(6.8)	4(9.3)	14(4.9)	13(5.3)
Belief that the disease would not likely become severe even if one were infected with influenza or pneumonia	6(5.1)	0(0.0)	3(1.1)	2(0.8)
Belief that the influenza is the same as common cold and that no special attention required	1(0.8)	-	4(1.4)	-
Inability to afford the vaccination	3(2.5)	0(0.0)	9(3.2)	9(3.7)
Others	1(0.8)	1(2.3)	3(1.1)	1(0.4)
Missing	1(0.8)	0(0.0)	0(0.0)	1(0.4)

Table 5. Effect of different practitioners' recommendations on influenza and pneumonia vaccination.

	First round				Second round			
	Influenza (n = 118)		Pneumonia (n = 43)		Influenza (n = 285)		Pneumonia (n = 243)	
Survey items	n	%	n	%	n	%	n	%
Effect of a health care practitioner's recommendation of influenza or pneumonia vaccination								
Definitely	7	5.9	2	4.7	20	7.0	13	5.3
Probably	36	30.5	12	27.9	96	33.7	77	31.7
It depends	25	21.2	10	23.3	78	27.4	64	26.3
Probably not	26	22.0	11	25.6	57	20.0	61	25.1
Definitely not	24	20.3	8	18.6	34	11.9	28	11.5
Effect of a general practitioner's recommendation of influenza or pneumonia vaccination								
Definitely	10	8.5	2	4.7	21	7.4	14	5.8
Probably	28	23.7	7	16.3	106	37.2	87	35.8
It depends	33	28.0	11	25.6	77	27.0	54	22.2
Probably not	25	21.2	15	34.9	51	17.9	57	23.5
Definitely not	22	18.6	8	18.6	30	10.5	31	12.8
Z value	−0.08		−0.86		−0.99		−0.50	
P value	0.94		0.39		0.32		0.62	

(χ^2 = 1837.45, *P*< .01) (Table 6). Before the study started, the influenza vaccination rate was less than 1.0%, and no participants had received the pneumococcal vaccine. By our health intervention, the vaccination rates increased year by year. Among the 20,766 chronic disease patients, the vaccination rates for influenza and pneumonia were 0.4% and 0.0%, between 2015 and 2016, respectively, and the vaccination rates rose to 9.4% and 3.9% from 2017 to 2018, respectively.

We also observed the vaccination status of the target population during the same periods. Among the participants in the intended survey, only 9 participants in Haining included in the first round had received the influenza vaccine before the study started. From June 2015 to May 2018, 32 participants in Haining and 55 participants in Tongxiang included in the second round of the intention survey received the influenza or pneumococcal vaccine. The inoculation rates

Table 6. Vaccination before and after the intervention.

		Overall study population				Intention survey population.			
Counties	Vaccine type	Before	After	Statistic	*P* value	Before	After	Statistic	*P* value
Haining		n = 10012	n = 10012			n = 358	n = 356		
	Get influenza vaccine	51(0.5)	711(7.1)	594.27	.00[a]	9(2.5)	32(9.0)	13.83	.00[a]
	Get pneumonia vaccine	0(0.0)	50(0.5)	50.13	.00[a]	0(0.0)	2(0.6)		.25[b]
	Total*	51(0.5)	711(7.1)	594.27	.00[a]	9(2.5)	32(9.0)	13.83	.00[a]
Tongxiang		n = 10754	n = 10754			n = 358	n = 331		
	Get influenza vaccine	27(0.3)	1241(11.5)	1235.12	.00[a]	0(0.0)	53(16.0)	62.10	.00[a]
	Get pneumonia vaccine	0(0.0)	766(7.1)	794.29	.00[a]	0(0.0)	36(10.98)	41.08	.00[a]
	Total*	27(0.3)	1258(11.7)	1254.20	.00[a]	0(0.0)	55(16.6)	14.33	.00[a]
Total[#]		N = 20766	N = 20766			n = 716	n = 687		
	Get influenza vaccine	78(0.4)	1952(9.4)	1818.89	.00[a]	9(1.3)	85(12.4)	69.3	.00[a]
	Get pneumonia vaccine	0(0.0)	816(3.9)	832.35	.00[a]	0(0.0)	38(5.5)	40.71	.00[a]
	Total*	78(0.4)	1969(9.5)	1837.45	.00[a]	9(1.3)	87(12.7)	71.57	.00[a]

[a]Chi-square test b Fisher's exact test
Total* means the number of participants who received influenza and/or pneumonia vaccine.
Total[#] means the total of the two counties.

improved markedly during the intention survey, and the improvement was statistically significant ($\chi^2 = 71.57$, $P < .01$) (Table 6).

Otherwise, on September 25, 2018, Haining introduced free influenza vaccination for individuals over 60 years old. As of December 10th, 2018, the vaccination rate for influenza was 39.1% in the region.

Discussion

Influenza and pneumonia are vaccine-preventable diseases and are common causes of hospitalization and death among elderly individuals, especially those with chronic diseases. Compared with the healthy population, patients with chronic diseases have a significantly higher mortality rate after being infected with influenza and pneumonia. Vaccination is the most effective approach to prevent influenza and pneumonia and their complications.[10,11] Our study showed that elderly patients were the main group of chronic disease patients; 87.5% of the participants were over 50 years old, and 56.2% were over 60 years old. Only 24.7% of the employed participants had a surplus in their private medical savings accounts, which can be used to pay for influenza and pneumonia vaccines. Most chronic disease patients have no balance in their private medical savings account, which means that these people must pay for category 2 vaccines out of pocket. Before the community health education intervention, the pneumonia vaccination rate among chronic disease patients was zero, and the influenza vaccination rate was only 0.4%, which was lower than the national average (2–3%);[12] far below the levels of Beijing, Tianjin, Shenzhen, and other places where free influenza vaccines have been provided for elderly individuals;[13–17] and far below the target of 75% influenza vaccination coverage among elderly individuals, which the World Health Assembly urged member states to achieve in 2003.[18]

Through the regular provision of various forms of health education activities for all chronic disease patients, especially through frequent public publicity 1–2 months before the start of the influenza season, the awareness rates about influenza, pneumonia, and related vaccines among chronic disease patients were greatly improved. The awareness rates of influenza and pneumonia have reached more than 70%, and the awareness rates of related vaccines have also increased significantly. The difference between the first and second rounds was statistically significant. The above results indicate that the community health education intervention had a significant positive effect on cognition of influenza and pneumonia in chronic disease patients and greatly improved the influenza and pneumonia vaccination rates, even though there is still room for improvement.

The survey findings on vaccination willingness indicated that from before to after the intervention, the proportion of the participants willing to be vaccinated (including those who responded definitely, probably and it depends on) markedly increased for influenza and pneumonia among participants who knew about the relevant vaccines but had not received them. The percentage of people who did not want to be vaccinated (including those who responded probably did not and definitely did not) showed a significant decrease after the intervention. Few participants thought there was a mandate for chronic disease patients to receive an influenza vaccine and/or pneumococcal vaccine. Before the community health intervention, nearly 70% of chronic disease patients believed they did not need to be vaccinated based on their good physiques and strong resistance. After the intervention, the proportion increased rather than deceased, indicating that the awareness of influenza and pneumonia vaccines in chronic disease patients was still inadequate. It is suggested that targeted health education and intervention measures should be adopted for different target populations and that the protective effect of vaccination for elderly individuals, especially chronic disease patients, should be emphasized to raise awareness among chronic disease patients of the dangers of influenza and pneumonia and the risks of not being vaccinated against them. In addition, the lack of recommendation by medical personnel before the health intervention was also an important reason for the low vaccination rate in the study area, suggesting that it is necessary to carry out health education interventions and improve the accessibility of vaccination services for chronic disease patients.

Compared with the immunization rates of influenza and pneumonia before and after intervention, the low rates in the chronic disease patients constantly improved year by year. The

same conclusion was obtained in other regions of China. Through community health intervention measures, the vaccination rate of patients with coronary heart disease increased from 4.32% to 7.89% in Xuzhou.[19] The results of our survey on the factors affecting the coverage rates showed that 77.8% of the participants who had received influenza vaccines before the intervention paid for the cost with their Medicare card, and the proportion of paying in cash was small. The payment method for vaccines is an important factor affecting the improvement of the vaccination rate. The influenza vaccination rate was approximately 50% in Beijing, and the pneumococcal vaccination rate was 37.1% in the Minhang district of Shanghai, both of which implemented a free immunization policy.[9,20,21] After Beijing implemented the free immunization policy, one study for people over 60 showed that even though 41.8% (180/431) respondents thought they were in good health and did not need to get vaccinated, 46.1% (83/180) of them still received influenza vaccine.[13,22] Our study was based on voluntary and non-free vaccination. In our study, there were also many respondents who believed they were in good health and did not need vaccination. The proportion of non-vaccination due to cost was very low. On September 25, 2018, Haining introduced free influenza vaccinations for individuals over 60 years old. But vaccination rates in the region have indeed improved dramatically. Comparison with the study in Beijing, we believe that the free vaccination policy has a positive effect on improving the vaccination rate, but it is also necessary to enhance public awareness through pertinence health education intervention.

Influenza and pneumonia are serious risks to patients with chronic diseases. Continuous community health education interventions can significantly improve the awareness of disease, vaccination intention, and vaccination rate of chronic disease patients, and a free vaccination policy is also an effective way to improve the vaccination rate. Therefore, different regions in China should adopt a series of comprehensive policies and measures that are suitable for the local condition to include chronic disease patients in the target groups for influenza and pneumonia vaccination. We hope this paper can provide suggestions for policy-makers to make the influenza and pneumonia vaccine more affordable to protect people's health.

There are a few limitations in the current study. First of all, the study was initially designed to provide relevant information and guidance within local culture and background, and therefore the extension of some conclusions for other parts of the province must be made with caution. Secondly, since it is a retrospective study, it suffered from several types of biases such as recall and researcher biases; however, we tried to limit these biases. For instance, researcher's measurement bias was mitigated by training investigators. Also, recall bias was mitigated by avoiding questions asking for recalled information. For instance, vaccination status was not only relied on self-report, we also inquired the Vaccination Management System. Third, two rounds of intention surveys were sampled from the entire population, respectively. The interval between the two rounds was 1 year. The objective was to observe the effect of persistent media coverage of influenza and pneumonia and consideration of vaccines over time. The design is self-controlled in the study population. Because of the publicity completely covering the two counties, we didn't set a standard control. This may affect the conclusion that the changes observed were due to the intervention.

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Author contributions

Conceptualization, E.C., Z.M. and Y.C.; methodology, Z.M. and Y.C.; organization, E.C., Z.M., Y.C., W.G. and B.H.; investigation, P.S., H.G., and Q.L.; writing—review and editing, Y.C. and Z.M.; All authors have read and agreed to the published version of the manuscript.

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