

## Knowledge and Attitude toward Pneumonia and Pneumococcal Polysaccharide Vaccine among the Elderly in Shanghai, China: A Cross-sectional Questionnaire Survey

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### Abstract

**Background:** The study is aimed at assessing the knowledge level of pneumonia and 23-valent pneumococcal polysaccharide vaccine (PPV23) and attitude toward PPV23 immunization among the elderly people residing in Shanghai, exploring related factors to improve the inoculation of PPV23, and providing evidence for effective intervention strategy to PPV23 uptake.

**Methods:** A cross-sectional study was conducted in Shanghai. Approximately 12000 household elderly aged 60 years and above from 12 neighborhoods (township) were chosen randomly to complete the questionnaires.

**Results:** A total of 11972 participants completed the questionnaires, 7414 (61.9%) of the participants knew about pneumonia, 8156 (68.1%) participants knew about PPV23. Of whom, 3649 people were responding to the question about PPV23 vaccination, 1315 (35.6%) were willing to receive PPV23. The awareness rate of PPV23 declined with age increase, and increased with education level and economic income increase. However, the willingness to accept the inoculation of PPV23 reduced by the education level and economic income increase. Over 80% of participants learned about PPV23 through television, posters, informed consents, people they know and physicians. Participants who didn't know about PPV23 were willing to gain information about PPV23 through physicians, television, people they know, staff in vaccination clinic and informed consents.

**Conclusions:** The willing to inoculate with vaccine was based on the knowledge. 73.6% of the informants heard about pneumonia and 68.1% of them heard about its vaccine. But they needed further information through physicians, television, people they know and so on. The healthcare providers were the key to promote vaccination, and should be encouraged to play even more important role in the program of inoculation with PPV23 for elders in Shanghai.

**Keywords:** Awareness; Perception; Pneumococcal vaccine; Older adult; Shanghai

### Background

#### About the disease

Pneumonia is a significant public health problem, with about 450 million people infected per year globally and about 4 million pneumonia related deaths [1]. The majority of pneumonia cases and related deaths occur in developing countries, especially in India, China and Pakistan [1,2]. As suggested by World Health Organization (WHO), children and adults aged 65 years or older were at increased risk of pneumonia [2]. Data from Shanghai Municipal Center for Disease Control and Prevention (SCDC) showed that the pneumonia incidence among elderly people in Shanghai is 0.31% per month in Huangpu and Changning Districts, and the estimated incidence was 3.67% per year [3]. Among infants and young children, old people and people with chronic diseases, pneumonia is the leading cause of death [1,4].

Pneumonia is mainly caused by infection with viruses or bacteria. Of bacteria caused pneumonia, *streptococcus pneumoniae*, a common human pathogenic bacterium is the major cause [4,5]. Elderly populations are particularly vulnerable to develop severe pneumococcal disease. When bacteria invades the bloodstream or other sterile sites, resulting in invasive pneumococcal disease (IPD), mostly is bacteraemic pneumonias, meningitis and sepsis. In each year, Canada reported approximately 3000 IPD cases, and most of which were among adults aged 60 years or older [6]. There is no accurate statistic on IPD cases in China. The estimated statistics showed that there were 2.5 million IPD cases and 12.5 thousand IPD related deaths in China every year [7].

#### About the vaccine

With the advancing antibiotic therapy and introduction of *Streptococcus pneumoniae* vaccines, the prognosis of pneumonia has been improved significantly. Clinical research suggested that the 23 value pneumococcal polysaccharide vaccine (PPV23) achieved a protection rate of 76-92% [8,9]. The Center for Disease Control and Prevention (CDC) confirmed that the effective protection by PPV23 was 75% for immunocompetent senior adults aged 65 years or older, 84% for adults with diabetic conditions, 73% for coronary artery disease patients, 69% for congestive heart-failure patients, and 65% for chronic respiratory diseases patients [10].

In the last 40 years, many countries offered PPV23 to children and elderly as part of national immunization program. However, the coverage of *Streptococcus pneumoniae* vaccination was limited in developed countries [11-13]. The opinion and acceptance of *Streptococcus pneumoniae* vaccination in developing countries remains

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unclear. Although, the PPV23 was recommended to use for children and elderly in China, the acceptance and coverage remained low and varied by individuals. Of the 100 thousand doses of PPV23 had been taken in Shanghai during 2000 to 2012, over 95% of doses were given to children. The Shanghai Municipal Commission of Health and Family Planning had offered free PPV23 vaccination for local residents aged 60 years or older since September 2013. Over the last 12 months, only a small proportion of local older underwent the PPV23 vaccination. It is likely due to the lack of knowledge of *Streptococcus pneumoniae* and PPV23 vaccination. This study aims to investigate knowledge and attitude about *Streptococcus pneumoniae* and the PPV23 vaccination among elderly people in Shanghai.

## Method

### Sampling procedure

The household elderly aged 60 years or above are the target population of the study. Stratified sampling was used and sampling unit are townships. All townships in Shanghai are divided into three groups by permanent resident population size, <20,000, 20,000-50,000 (except 50,000) and ≥50,000. Since 1,000 elderly are needed in each township and the elderly account for about 25% of permanent residents, a township with less than 4,000 populations will be merged with nearby townships until the population size is over 4,000. 4 townships are randomly chosen in each group. And Xiao Dongmen sub-district in Huangpu district, Hu'nan sub-district in Xuhui district, Taopu township in Putuo district, Zhi Jiangxi sub-district in Zhabei district, Daqiao sub-district in Yangpu district, Xinhong sub-district in Minhang district, Gucun township in Baoshan district, Huating township in Jiading district, Xinbang township and Zhongshan sub-district in Songjiang district, Baihe township in Qingpu district, Haiwan township in Fengxian district were chosen as the studying fields. These 12 townships were diffused in 11 districts in Shanghai, where had a total of 17 districts. These townships had no common boundary with each other.

In the year 2004, SCDC had taken a community survey about incidence rate of the community-acquired pneumonia among elders in two communities. And the estimated incidence rate of pneumonia in a year was 3.67%. The allowable error ( $\delta$ ) was 0.005, and the efficiency of sample (Deff) was set as 2. The simple random sampling formula was used to count the number of study and got 11953 people at least. A total of 12,000 elderly are chosen for enrollment: 1,000 each in 12 townships. Elderly with no mental illness and hearing disorder are eligible for the study.

### Questionnaire design

The survey was conducted by questionnaire. Two types of questionnaires were used, basic and advanced ones. All questions in the basic questionnaire are included in the advanced one. There are 19 questions in the basic questionnaire. 6 are about pneumonia occurrence in the past year, 5 are about knowledge of pneumonia and pneumococcal vaccine, 8 are about demographic information. There are 4 sections and a total of 36 questions in the advanced questionnaire. The first section is about pneumonia occurrence in the past year and knowledge and attitude of pneumonia. The second section is about knowledge and attitude of pneumococcal vaccine. The third section is about health seeking behaviour and willingness to receive PPV23. The fourth section is demographic information. 16% (3/19) questions in the basic questionnaire are optional, 28% (10/36) questions in the extended questionnaire are optional. 5% (1/19) in the basic questionnaire are multiple choice questions. 19% (7/36) in the extended questionnaire are multiple choice questions.

The questions were designed as the optional ones, which was easy

for elder to response. And the questionnaires were written by Chinese, which was the mother language of the respondents. When some elders were asked whether they knew the disease or vaccine, they would answer yes. But they could not tell the detail about any of question when the investigator kept asking for. So "Yes but litter" was set as the answer portion in the questionnaire for the situation above. Before the survey was taken, 100 elders were chosen to finish these questionnaires in another township. Base on the response to the questions and answer portions, the questionnaires were revised and perfect.

### Data collection and analysis

The study was designed as a cross-section descriptive study. 12000 elders were asked to finish the basic questionnaires, and 3600 participants from them (200 each in 6 townships and 400 each in the other 6 townships) were asked to complete the advanced questionnaires. Questionnaires were completed by the staff in vaccination clinics by asking participants the questions. The staff once worked (or are working) in district CDCs or community healthcare centers and were trained with research skills in Shanghai CDC. Questionnaires were reviewed by district CDCs, unqualified questionnaires would be re-completed by the relevant participants. Data were double entered and checked by Epidata 3.1. Statistical analyses were performed by SPSS Statistics 17.0. Chi-square test was used in the table data's analyses. And t test was used for the comparison of average.

### Ethical

This study was performed as part of Shanghai Major Public Health Service Program which was approved by Shanghai government. Participants were informed the study purpose and their rights. Personal information such as names, addresses, or phone numbers was not included in the survey. The study design had passed the ethic review which was organized by SCDC's ethics committee.

## Results

### Study population

A total of 11972 participants completed the questionnaire, of whom, 8278 completed the basic one, these other 3694 completed the advanced one. Since all the participants in Gucun Township, Baoshan district were offered the advanced one, the number of collected questionnaire is a little bit different from expected. Participants were from 12 districts or township of Shanghai, with an average age of 70 years (range: 60-101 years); 54.7% of participants were female and 45.3% were male. Farmers (39.0%) and general workers (32.1%) accounted for more than half of the participants, followed by service industry workers (5.6%), teachers (3.3%), civil servants (2.1%), healthcare providers (1.9%), etc.; 94% of the participants were educated, of whom, 39.3% owned primary school degree, 32.9% owned junior high school degree, 21.6% owned high school degree or above; 61.3% of the participants had 10,000 to 50,000 RMB disposable income per year, 29.1% had annual income lower than 10,000 RMB.

### Knowledge of pneumonia and pneumococcal vaccine

**Knowledge of pneumonia and characteristics:** Among 11972 responders, 61.9% of the participants know about pneumonia. Male participants have higher awareness rates of pneumonia than female participants. Awareness rates decreases with the increased age. Healthcare providers had the highest awareness rates, followed by teachers, company employees, and general workers. Except people with no stable job, farmers had the lowest awareness rates. People with higher educational level and higher disposable income had higher awareness rates (Table 1).

**Relations between knowledge of pneumonia and diseases occurrence:** A total of 3754 (31.4%) participants recalled that they had suffered from pulmonary diseases in the past year, of whom, 65.5% knew about pneumonia. For participants who didn't suffer from pulmonary diseases in the past year, 60.3% knew about pneumonia. For participants who had been diagnosed as pneumonia, 86.9% knew about pneumonia. For participants who had been diagnosed as other pulmonary diseases, 67.7% knew about pneumonia (Table 2).

**Knowledge about prevention of pneumonia:** When asked whether pneumonia is preventable, 73.6% of participants said yes. Among the 7414 participants who said knew about pneumonia, 3777 (54.8%) participants believed pneumonia can be prevented by exercises, and 855 (12.4%) ones believed vaccination (Table 3).

**Knowledge of PPV23 and ways to learn about PPV23:** Among 11972 responders, 8156 (68.1%) participants knew about PPV23. Detailed results about knowledge of PPV23 by population are shown in Table 4. Male participants showed higher awareness rates of PPV23 than female participants. Participants aged 60-69 years, with higher educational level or higher income showed higher awareness rates. Teachers, healthcare providers, company employees and general workers also showed higher awareness rates. Among 3694 participants who completed the advanced questionnaires and knew about PPV23 were asked which population is suitable for PPV23, 47.0% believed PPV23 has protective effect on both adults and children, 26.3% believed PPV23 has effect only on adults and 8.0% believed PPV23 has effect only on children (Table 4).

Among participants who knew about PPV23 were asked about the ways they learned about it, over 80% learned about PPV23 through television, posters, informed consents, people they knew and physicians. Participants who didn't know about PPV23 were willing to gain information about PPV23 through physicians, television, people

they know, staff in vaccination clinic and informed consents.

**Multinomial logistic analysis:** Adding the age, sex, career, education, and income as factors into logistic analysis, the result showed that age (younger than 80 years old), and income (50,001-100,000 RMB per year) were the significant factors to increase the knowledge degree of pneumonia. And the age (younger than 80 years old), career (as teacher), and income (below 100,000 RMB per year) were the significant factors to increase the knowledge degree of PPV23. Career (as no stable job) was the significant factor to decrease the knowledge degree of PPV23.

### Willingness to receive PPV23

Only 3694 participants who completed advanced questionnaires were asked whether they were willing to receive PPV23, and 3692 participants answered this question. Among them, 1315 (35.6%) were willing to receive PPV23. Willingness was 35.8% in male participants and 35.4% in female participants without significant difference. Younger participants had higher willingness. Participants aged 60-65 years had the highest willingness. Farmers were more willing to receive PPV23 (40.9%). Participants with junior to high school degree were more willing to receive PPV23 (39.1%). Participants with lower disposable income were more willing to receive PPV23. Willingness to receive PPV23 was highest among participants with less than 10,000 RMB disposable income per year (41.9%), lowest among participants with more than 50,000 RMB disposable income per year (20.0%).

**Relations between willingness to receive PPV23 and knowledge of pneumonia, knowledge of PPV23 and health seeking behaviour:** Willingness to receive PPV23 was lower in participants who knew about PPV23 (32.6%) than participants who didn't know about PPV23 (39.6%) (Table 5). Participants were preferred to receive PPV23, who preferred self-observation at first when they got pulmonary illness and

		Knowledge of pneumonia (n = 11972)				X <sup>2</sup> , P value
		Yes (%)	Yes but litter (%)	No (%)	Total (%)	
<b>Total</b>		7414 (61.9)	3545 (29.6)	1013 (8.5)	11972 (100.0)	
<b>Sex</b>	Male	3460 (63.7)	1572 (28.6)	417 (7.7)	5429 (100.0)	15.885, P < 0.001
	Female	3954 (60.4)	1993 (30.4)	596 (9.1)	6543 (100.0)	
<b>Age group</b>	60-64	1894 (65.5)	822 (28.4)	177 (6.1)	2893 (100.0)	302.259, P < 0.001
	65-69	2233 (66.0)	939 (27.7)	212 (6.3)	3384 (100.0)	
	70-74	1386 (63.3)	619 (28.3)	183 (8.4)	2188 (100.0)	
	75-79	977 (59.1)	527 (31.9)	150 (9.1)	1654 (100.0)	
	80-84	610 (55.1)	347 (31.3)	151 (13.6)	1108 (100.0)	
	85-89	182 (43.0)	174 (41.1)	67 (15.8)	423 (100.0)	
	≥90	46 (44.7)	43 (41.7)	14 (13.6)	103 (100.0)	
<b>Occupation/ previous occupation</b>	Teacher	288 (71.8)	99 (24.7)	14 (3.5)	401 (100.0)	382.728, P < 0.001
	Healthcare provider	168 (75.3)	45 (20.2)	10 (4.5)	223 (100.0)	
	Civil servant	140 (55.1)	84 (33.1)	30 (11.8)	254 (100.0)	
	Company employee	1000 (70.3)	346 (24.3)	76 (5.3)	1422 (100.0)	
	Service industry worker	405 (60.3)	222 (33.0)	45 (6.7)	672 (100.0)	
	General worker	2671 (69.5)	943 (24.5)	230 (6.0)	3844 (100.0)	
	Farmer	2470 (52.9)	1645 (35.2)	556 (11.9)	4671 (100.0)	

	No stable job	179 (52.8)	120 (35.2)	40 (11.8)	339 (100.0)	
	Other	84 (62.7)	39 (29.1)	11 (8.2)	134 (100.0)	
	Refuse to answer	-	-	-	12	
Educational level	Primary school or below	2556 (54.3)	1638 (34.8)	509 (10.8)	4703 (100.0)	432.097, $P < 0.001$
	Junior high school	2701 (68.5)	1014 (25.8)	226 (5.7)	3941 (100.0)	
	Senior high school	1173 (68.8)	448 (26.3)	83 (4.9)	1704 (100.0)	
	College or above	643 (72.3)	194 (21.8)	52 (5.8)	889 (100.0)	
	Illiteracy	313 (46.6)	226 (33.6)	133 (19.8)	672 (100.0)	
	Unsure	19 (37.3)	23 (45.1)	9 (17.6)	51 (100.0)	
	Refuse to answer	-	-	-	12	
Disposable income	<10,000 RMB	1898 (54.4)	1170 (33.6)	419 (12.0)	3487 (100.0)	422.630, $P < 0.001$
	10,000-50,000 RMB	4905 (66.8)	1993 (27.2)	440 (6.0)	7338 (100.0)	
	50,001-100,000 RMB	422 (68.8)	147 (24.0)	44 (7.2)	613 (100.0)	
	>100,000 RMB	18 (64.3)	4 (14.3)	6 (21.4)	28 (100.0)	
	Unsure	162 (32.8)	229 (46.4)	103 (20.9)	494 (100.0)	
	Refuse to answer	-	-	-	12	

**Table 1:** Knowledge of pneumonia by population.

Pulmonary diseases occurrence in the past year	Knowledge of pneumonia			Total (%)	$\chi^2$ , $P$ value
	Yes (%)	Yes but little (%)	No (%)		
Yes	2459 (65.5)	1078 (28.7)	217 (5.8)	3754 (100.0)	59.222, $P < 0.001$
No	4955 (60.3)	2467 (30.0)	796 (9.7)	8218 (100.0)	
Total	7414 (61.9)	3545 (29.6)	1013 (8.5)	11972 (100.0)	

**Table 2:** Relations between the occurrence of pulmonary diseases in the past year and knowledge of pneumonia.

Is pneumonia preventable?	Knowledge of pneumonia			$\chi^2$ , $P$ value
	Yes (%)	Yes but little (%)	Total (%)	
Yes	5460 (73.6)	1532 (43.2)	6992 (61.3)	1426.007, $P < 0.001$
No	677 (9.1)	604 (17.0)	1281 (11.5)	
Unsure	1277 (17.2)	1409 (39.7)	2686 (27.2)	
Total	7414 (100.0)	3545 (100.0)	10959 (100.0)	

**Table 3:** Relations between knowledge of pneumonia and knowledge of preventability of pneumonia.

sought hospital care after disease progression (Table 6).

**Factors influencing willingness to receive PPV23:** All of participants showed interest in knowledge of PPV23 regardless of their willingness to receive it. Over 90% participants showed interest in information on safety, effectiveness, recommended population, vaccination notice, when and where to get vaccinated. Even if PPV23 is not free for vaccination, the expense for PPV23 is not a concern. Over 95% participants were willing to receive PPV23 at community healthcare center for convenience.

## Discussion

China has made great achievement in vaccination program and

vaccine-preventable diseases during the past 30 years. Reported vaccine coverage in many areas in China has reached 95% or above [14]. The Chinese government was paying more attention to adult vaccination in recent years. Free influenza vaccination has been implemented in high-risk people including the elderly in Beijing [15]. PPV23 is recommended for special adults at high-risk of pneumonia. People aged 65 years or above receive PPV23 for free in the United States [16]. The elderly with chronic diseases or respiratory diseases in many European countries is recommended to receive at least 1 dose of PPV23 [4,13,17]. Such public health strategies are also implemented in Taiwan [18]. The studies proved that PPV23 vaccination in the elderly is cost-effective and can save the costs of local government in treatment of pneumonia [19,20]. There are also proofs that effectiveness of PPV23 was stable over 10 years [21].

Our survey started at the very beginning of the free PPV23 vaccination program, aiming to learn about the elderly's knowledge and attitude about pneumonia, pneumococcal vaccine and their willingness to receive PPV23. Over half of the participants knew about pneumonia and its vaccine. Most of participants had high educational background, high income such as, healthcare providers or teachers. Our results showed that participants who had pneumonia before knew more about pneumonia. The finding is similar to that of a previous study of Pang H, etc. Unexpectedly, our results showed that participants who knew more about pneumonia and PPV23 were less likely to receive PPV23. Obviously, there is a negative correlation between willingness to receive PPV23 and knowledge about pneumonia and PPV23. It is different from the results of a study of Pang H, Chen QX, etc. [22]. We presumed that participants who claimed to know about PPV23 may not understand the benefit of vaccine exactly. Many participants who claimed to know about PPV23 didn't know how to prevent pneumonia and the recommended population of PPV23. The elders might get the news from television of broadcast, and few of them received the further information about the disease and its vaccine. When the doctors told them how serious the pneumonia could cause diseases, the elders might say yes and I agree with your command. But few of them could take actions like seeking for vaccine inoculation immediately. And the elders have limited knowledge about pneumonia and how to prevent pneumonia also. Free PPV23 vaccination is available to local elderly



		Knowledge of PPV23 (n = 11972)			X <sup>2</sup> , P value
		Yes (%)	Yes but little (%)	Total (%)	
Sex	Male	3765 (69.4)	1664 (30.6)	5429 (100.0)	6.855, P < 0.05
	Female	4391 (67.1)	2152 (32.9)	6543 (100.0)	
Age group	60-64	2065 (71.4)	828 (28.6)	2893 (100.0)	199.668, P < 0.001
	65-69	2449 (72.4)	935 (27.6)	3384 (100.0)	
	70-74	1501 (68.6)	687 (31.4)	2188 (100.0)	
	75-79	1112 (67.2)	542 (32.8)	1654 (100.0)	
	80-84	660 (59.6)	448 (40.4)	1108 (100.0)	
	85-89	214 (50.6)	209 (49.4)	423 (100.0)	
	≥90	51 (49.5)	52 (50.5)	103 (100.0)	
	Unsure	104 (47.5)	115 (52.5)	219 (100.0)	
Occupation/ previous occupation	Teacher	342 (85.3)	59 (14.7)	401 (100.0)	255.844, P < 0.001
	Healthcare provider	174 (78.0)	49 (22.0)	223 (100.0)	
	Civil servant	161 (63.4)	93 (36.6)	254 (100.0)	
	Company employee	1096 (77.1)	326 (22.9)	1422 (100.0)	
	Service industry worker	463 (68.9)	209 (31.1)	672 (100.0)	
	General worker	2741 (71.3)	1103 (28.7)	3844 (100.0)	
	Farmer	2908 (62.3)	1763 (37.7)	4671 (100.0)	
	No stable job	174 (51.3)	165 (48.7)	339 (100.0)	
	Other	91 (67.9)	43 (32.1)	134 (100.0)	
	Refuse to answer	-	-	12	
Educational level	Primary school or below	3007 (63.9)	1696 (36.1)	4703 (100.0)	265.269, P < 0.001
	Junior high school	2774 (70.4)	1167 (29.6)	3941 (100.0)	
	Senior high school	1307 (76.7)	397 (23.3)	1704 (100.0)	
	College or above	702 (79.0)	187 (21.0)	889 (100.0)	
	Illiteracy	336 (50.0)	336 (50.0)	672 (100.0)	
	Unsure	24 (47.1)	27 (52.9)	51 (100.0)	
Disposable income	Refuse to answer	-	-	12	137.304, P < 0.001
	<10,000 RMB	2255 (64.7)	1232 (35.3)	3487 (100.0)	
	10,000-50,000 RMB	5180 (70.6)	2158 (29.4)	7338 (100.0)	
	50,001-100,000 RMB	455 (74.2)	158 (25.8)	613 (100.0)	
	>100,000 RMB	20 (71.4)	8 (28.6)	28 (100.0)	
	Unsure	240 (48.6)	254 (51.4)	494 (100.0)	
		Refuse to answer	-	12	

**Table 4:** Knowledge of PPV23 by population.

Knowledge of PPV23	Willingness to receive PPV23				X <sup>2</sup> , P value
	Yes (%)	No (%)	Unsure (%)	Total (%)	
Yes	692 (32.6)	1303 (61.5)	125 (5.9)	2120 (100.0)	32.013, P < 0.001
No	623 (39.6)	903 (57.4)	46 (2.9)	1572 (100.0)	
Total	1315 (35.6)	2206 (59.8)	171 (4.6)	3692 (100.0)	

**Table 5:** Relations between knowledge of PPV23 and willingness to receive PPV23.

people in Shanghai when this study started. Thus, we think that income level may barely influence their willingness to receive PPV23. Willingness to receive PPV23 is mainly associated with their opinion on the effectiveness and safety of PPV23. For farmers living in rural area had limited access to medical resources. They were more willing to receive PPV23 than people living in urban area. For the elderly people with lower education level, they were more willing to receive PPV23. This finding is similar to a previous study about influenza vaccination in elderly conducted in Beijing [23].

Healthcare providers are supposed to be promoters and educators

of disease prevention knowledge [24]. However, healthcare providers participating in this survey barely support preventing pneumonia through PPV23 vaccination. Similarly, healthcare providers are target prior population in MCV (measles containing vaccine) SIA (supplementary immunization activity), but MCV coverage in healthcare providers remains low in Shanghai. Healthcare providers are likely to overestimate the adverse consequences of immunization. Healthcare providers made limited contribution in promoting immunization, which is also proved by some KAP (knowledge, attitude, practice) studies in other countries [25].

Health seeking behavior	Willingness to receive PPV23			Total (%)
	Yes (%)	No (%)	Unsure (%)	
No treatment	42 (28.6)	100 (68.0)	5 (3.4)	147 (100.0)
Observe first, go to hospital after disease progression	651 (44.0)	782 (52.8)	48 (3.2)	1481 (100.0)
Go to hospital immediately	353 (28.4)	812 (65.4)	77 (6.2)	1242 (100.0)
Take medicine on his/her own without seeking medical help	265 (32.6)	507 (62.4)	41 (5.0)	813 (100.0)
Other	4 (44.4)	5 (55.6)	0 (0.0)	9 (100.0)
Total	1315 (35.6)	2206 (59.8)	171 (4.6)	3692 (100.0)

**Table 6:** Relations between willingness to receive PPV23 and health seeking behavior.

Elders were weak in health and easy to get illness people. In the opposite, many of them would consider about less health serves in order to reduce the financial expenditure of the whole family. Being retired would give more time for elders to communicate with each other, and they showed much more group effectiveness strongly. They preferred to receive the suggestions from the believable people like familiar clinic doctors, authority of the elderly, and etc. Rumor and adverse events following immunization could break down the willing to inoculate easily. Even more health education and affirmative publicity should be taken during the immunization program. Otherwise, the willing to inoculate for PPV23 in elders would be declined. Lower willing to inoculate free vaccine may cause the wasting of resources in public health. And low rate of vaccine inoculation will become the barrier of requesting new policy of immunization in the future. For the public health staff, the questions should be consider all the time that how to rise the knowledge and willing to inoculate.

## Conclusion

To increase the coverage of PPV23 in the elderly in Shanghai, advocacy work is essential. Advocacy work started half a year before the beginning of PPV23 vaccination. Posters were distributed in every community. Informed consents were provided to residents by community healthcare centers and rural doctors. Advertisement was on television and broadcast. Many staffs in neighborhood committees took part in advocacy work as well. Indeed, people hope to gain more knowledge about PPV23, such as safety, effectiveness, recommended population, vaccination notice, when and where to get vaccinated, and etc. In order to raise public's willingness to receive PPV23, advocacy work needs to be improved and popularized. Healthcare providers should set a positive example for the public and lead them to learn more about PPV immunization.

## Strength and Limitations

Shanghai is the first province to perform the free vaccination of PPV23 among the elders in China. And other provinces or cities in China would take such immunization program in the future. The study will offer some useful evidences of the knowledge and awareness of the pneumonia and its vaccine among elders for the public health staff.

But the willing to inoculate was under the influence of many factors like group effect, guidance of public opinion, rumor, adverse event following immunization, and so on. And the willing rate was dynamic changed during the whole inoculation process. A cross-section study could not find the dynamic variation or many factors to the willing. So the further study should be taken during the free PPV23 vaccination for elders in Shanghai.

## Competing Interests

The authors declare that they have no competing interests.

## Authors' Contributions

XDS contributed to conception and design of the study, analysis and interpretation of data, and drafted the manuscript. XG contributed to data collection, analysis and interpretation. JR contributed to data collection and analysis, YPW contributed to data analysis and paper structure setting, QCP contributed to site choosing and survey organizing, GMZ contributed to conception and design of the study. All authors read and approved the final manuscript.

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