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The free vaccination policy of influenza in Beijing, China: The vaccine coverage and its associated factors

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ABSTRACT

Background: In order to improve influenza vaccination coverage, the coverage rate and reasons for non-vaccination need to be determined. In 2007, the Beijing Government published a policy providing free influenza vaccinations to elderly people living in Beijing who are older than 60. This study examines the vaccination coverage after the policy was carried out and factors influencing vaccination among the elderly in Beijing.

Methods: A cross-sectional survey was conducted through the use of questionnaires in 2013. A total of 1673 eligible participants were selected by multistage stratified random sampling in Beijing using anonymous questionnaires in-person. They were surveyed to determine vaccination status and social demographic information.

Results: The influenza vaccination coverage was 38.7% among elderly people in Beijing in 2012. The most common reason for not being vaccinated was people thinking they did not need to have a flu shot. After controlling for age, gender, income, self-reported health status, and the acceptance of health promotion, the rate in rural areas was 2.566 (95% confidence interval [CI], 1.801–3.655, $P < 0.010$) times greater than that in urban areas. Different mechanisms of health education and health promotion have different influences on vaccination uptake. Those whom received information through television, community boards, or doctors were more likely to get vaccinated compared to those who did not (Odds Ratio [OR] = 1.403, $P < 0.010$; OR = 1.812, $P < 0.010$; OR = 2.647, $P < 0.010$).

Conclusion: The influenza vaccine coverage in Beijing is much lower than that of developed countries with similar policies. The rural–urban disparity in coverage rate (64.1% versus 33.5%), may be explained by differing health provision systems and personal attitudes toward free services due to socioeconomic factors. Methods for increasing vaccination levels include increasing the focus on primary care and health education programs, particularly recommendations from doctors, to the distinct target populations, especially with a focus on expanding these efforts in urban areas.

1. Introduction

Influenza is a major cause of morbidity and mortality worldwide. It is responsible for 3–5 million cases of severe illness and 250–500 thousand deaths annually [1]. People aged 65 years and over are at great risk of severe illness and possibly even death [2]. Thus, the elderly are included among the priority groups targeted for vaccination because of their high risk of serious complications due to influenza resulting in hospitalizations or death [3]. To defend against influenza, the major strategy for controlling influenza is yearly immunizations [4] as recommended by the World Health Organization (WHO). Vaccinations have been shown to be the most effective prevention measure to reduce viral infection [5–9], especially for the elderly [10]. The Center for Disease Control and Prevention of the United States also recommends annual flu vaccination for members of these priority groups [11].

Although vaccination has been recommended for many years, a huge disparity exists between vaccine coverage of different countries. In countries that did not provide free vaccines, the rate of vaccination remained low. In 2008, the coverage in Poland was 13.4% [12] for people over 65 years, much lower than in other

Abbreviations: CI, confidence interval; OR, Odds Ratio; WHO, World Health Organization; PPS, Probability Proportionate to Size Sampling; LR, Likelihood Ratio.

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European countries and revealing that economic factors may be important predictors of coverage. In developed countries, especially those with policies for providing free vaccines, the coverage of the influenza vaccination is relatively higher but generally still remains lower than the target of 75% set in 2014 by the Council of the European Union [13]. Australia has provided free vaccines to the elderly since 1999 and the coverage was 78% in 2001 [14]. The coverage rates in the United States in 2014–2015 and in the United Kingdom in 2014 were 72.7% and 70.8%, respectively, for adults over the age of 65 [15].

Besides economic reasons, some research has been conducted to identify factors influencing coverage under a free vaccination policy in different localities, for instance, the United States [16,17], Canada [18], England [19,20], and other places in Asia [21–23]. These studies cite many reasons explaining why people may not get vaccinated. Common reasons include the belief that the flu vaccination is unnecessary or ineffective [22], lack of information [7], fear of side effects [20], as well as others. In addition, recommendations from doctors also play an important role in uptake. In summary, different social backgrounds, beliefs, and health systems may result in differing impacts on the coverage rate of vaccination, even when the same general policies providing free vaccinations are implemented.

Winter through early spring is peak influenza season in Beijing. Beijing's municipal government has provided free influenza vaccinations for people over 60 years old annually in October and November since 2007, becoming the first municipal government in the country to do so. Eligible people can get a flu shot in hospitals and community health care centers using their identification cards. Therefore, Beijing's experience is very important as a reference for the other 33 municipal governments as well as other developing countries in their own implementation of such governmentally subsidized public health programs. Studies conducted in China showed that when vaccination fees exist, coverage remains low (overall coverage rate was 6.1% in 1999) [24]. However, studies about the coverage rates after the introduction of the policy and whether the policy has a positive or negative impact on local vaccination coverage are still limited. Moreover, previous studies on the same type of policy in various different countries even produce disparate results, due to underlying societal and health system factors of diversity. As such, the China's experience with the free vaccination policy is likely to be unique. Which social and economic factors influence health behavior under the free vaccination policy and to what degree they do so deserve investigation into.

The aim of this study is to investigate the coverage of influenza vaccination and to identify factors associated with the uptake of the flu vaccination among the elderly in Beijing after the implementation of the free vaccine policy.

2. Materials and methods

2.1. Study design

A cross-sectional questionnaire-based survey was conducted in June 2013. The questionnaires were distributed to elderly people 60 and older who have lived in Beijing for at least one year. The data were collected by trained interviewers, recruited from medical students. The structured interview was conducted in the participants' home in-person. The answer was recorded by the researchers when there were elderly people with disabilities or low levels of education in order to ensure the quality of the data. Still, the questionnaire remains anonymous as there was no identifying information included in the questionnaire. This study was approved by the Peking University Health Science Center Institutional Review Board on 2013 (IRB00001052-13080), prior to the commencement of participant selection. All participants signed the informed consent form and confidentiality was maintained.

2.2. Sampling

The formula used to estimate the sample size was as follows: $N = \frac{Z_a^2 \pi(1-\pi)}{\delta 2}$ with an α error of 5%, a permissible error (δ) of 0.1, and a level of power of 0.8. According to a previous study in Beijing, the lowest yearly coverage rate between 2006 and 2009 was 19.5% [25], which was used for the calculation of sample size to ensure a larger minimum sample size. Therefore, a minimum sample size of 1585 questionnaires was calculated to obtain accurate estimates for influenza vaccination coverage rates.

A stratified multistage probability sampling design was used to select the participants. Since 2005, Beijing's 16 districts have been divided into 4 belts by the local government according to their geographic location, economic development status, and industry function [26]. For this study, 2 districts in each belt were selected randomly (8 districts in total), considering the representativeness and sample size. In each district, 8 communities were selected by the Probability Proportionate to Size (PPS) Sampling method, which means communities with more elderly people had a higher probability of being sampled. In each community, 30 individual elderly people were selected by systematic sampling according to a list of names obtained from the administration of the community. Therefore, 1920 participants in total were planned to guarantee the sample size. Subjects who had severe psychosis or were not willing to take part in the study were excluded and all participants were informed of their rights. Of 1717 eligible participants, 1673 finished the questionnaire (response rate 97.7%). A *P*-value of 0.05 was considered statistically significant.

2.3. Research tool

The data-collection instrument was designed by School of Public Health Peking University. The questionnaire included demographic information, vaccination status, attitude toward vaccination, and source of vaccination information. Demographic information included age, gender, level of education, occupation, income, and household registration status. Reasons for remaining unvaccinated, personal willingness to be vaccinated, and their source of information about the free vaccination policy were also assessed by the questionnaire. Additionally, the elderly people were asked if they suffered from any chronic diseases, including hypertension, diabetes, hyperlipidemia, chronic obstructive pulmonary disease, heart disease, stroke, and asthma. Vaccination status was recalled by participants. A draft of the questionnaire was tested in a pilot study also using the elderly and then revised. After completion, questionnaires were checked twice in the field to ensure their quality.

2.4. Statistical analysis

For univariate variables, frequencies and proportions were calculated. To describe the characteristics of the respondents, calculations were performed to assess the percentage distribution of variables. The chi-square test for dichotomous variables was calculated to examine the relationship between vaccine status and demographic characteristics. Predictor variables were selected for logistic regression models to determine potential independent predictors of vaccine uptake. The multivariate analysis results were derived by hierarchical regression for the variable selection, since we need to include certain variables according to our study assumption. We also explored the function of interaction terms of each socioeconomic status variable (gender, age, and monthly income)

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