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SHORT REPORT

Innovations in adult influenza vaccination in China, 2014–2015: Leveraging a chronic disease management system in a community-based intervention

Bo Yi[a,†], Suizan Zhou[b,†], Ying Song[b], Enfu Chen[c], Xuyin Lao[a], Jian Cai[c], Carolyn M. Greene[b], Luzhao Feng[d], Jiandong Zheng[d], Hongjie Yu[d], and Hongjun Dong[a]

[a]Ningbo Center for Disease Control and Prevention, Ningbo, Zhejiang Province, China; [b]Influenza Division, U.S. Centers for Disease Control and Prevention, Atlanta, GA, USA; [c]Zhejiang Provincial Center for Disease Control and Prevention, Hangzhou, Zhejiang Province, China; [d]Division of Infectious Disease, Chinese Center for Disease Control and Prevention, Beijing, China

ABSTRACT

Objectives: To evaluate a community-based intervention that leveraged the non-communicable disease management system to increase seasonal influenza vaccination coverage among older adults in Ningbo, China. **Methods:** From October 2014 – March 2015, we piloted the following on one street in Ningbo, China: educating community healthcare workers (C-HCWs) about influenza and vaccination; requiring C-HCWs to recommend influenza vaccination to older adults during routine chronic disease follow-up; and opening 14 additional temporary vaccination clinics. We selected a non-intervention street for comparison pre- and post-intervention vaccine coverage. In April 2016, we interviewed a random sample of unvaccinated older adults on the intervention street to ask why they remained unvaccinated. **Results:** Pre-intervention influenza vaccine coverage among adults aged 60 years and older on both streets was 0.3%. Post-intervention, coverage among adults 60 years and older was 19% (1338/7013) on the intervention street and 0.4% (20/5500) on the non-intervention street ($p<0.01$). Among vaccinated older adults, 98% reported their main reason for vaccination was receiving a C-HCW's recommendation, 90% were vaccinated at temporary vaccination clinics, and 53% paid for vaccine (10 USD) out-of-pocket. Reasons for not getting vaccinated among 150 unvaccinated adults (response rate = 75%) included: good health (39%); not trusting C-HCWs' recommendations (24%); not knowing where to get vaccinated (17%); and not wanting to pay (9%). **Conclusions:** Recommending influenza vaccination within a non-communicable disease management system, combined with adding vaccination sites, increased vaccine coverage among older adults in Ningbo, China.

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Introduction

Every year, seasonal influenza leads to an estimated 3 million severe illnesses and 250,000–500,000 deaths globally.[1] In one city in China, influenza was associated with an estimated 115–142 hospitalizations per 100,000 during 2010–2012.[2] The economic burden of influenza-associated medical care, especially among populations at highest risk for influenza-related complications such as older adults, is substantial. In China, one study demonstrated that the mean cost per inpatient visit among adults aged 60 years and older (US$ 2,735) was almost two times higher than among adults less than 60 years of age (US$ 1,417–1,621).[3] China has the largest population of older adults in the world, with 201.3 million persons 60 years of age and older in 2014.[4] Unless vaccination rates increase, the disease and economic burden caused by influenza illness among older adults in China will only increase as this population grows.

Annual vaccination is an effective and economic way to prevent seasonal influenza illness among older adults. Both the Chinese Center for Disease Prevention and Control (China CDC)[5] and the World Health Organization (WHO)[6] recommend prioritizing older adults for annual seasonal influenza vaccination. However, during 2009–2012, the seasonal influenza vaccine coverage among older adults in China was less than 8%.[7]

In China, vaccines are divided into two categories. Category A vaccines, part of the national Expanded Program on Immunization (EPI), are mandated vaccines provided to children less than 14 years of age at no cost. Category B vaccines, such as seasonal influenza vaccine, are not included within EPI; they are optional, and are usually delivered at cost to recipients upon request. China's CDC system is the country's public health technical lead, responsible for surveillance, vaccination programs, public health guidelines, training, and outbreak response. The hospital system, providing curative medical services, is usually separate. However, the two systems are linked within community health centers. Community healthcare workers (C-HCWs) within community health centers conduct both preventive and curative medicine; they provide primary care, immunization services and health education. Further, C-HCWs care for high risk populations, including adults with chronic diseases, pregnant women and young children through the existing non-communicable disease (NCD), maternal and child health care, and immunization heath systems. In the

CONTACT Hongjun Dong donghj@nbcdc.org.cn No. 237, Yongfeng Road, Haishu District, Ningbo, 315010, P.R. China.

[†]These authors contributed equally to this work.

NCD management system, C-HCWs provide quarterly check-ups to all adults with diagnosed hypertension, diabetes, cerebrovascular disease and cancer.

In this paper, we describe the implementation and evaluation of a community intervention that leveraged the existing community NCD management system to increase seasonal influenza vaccination among older adults on one street, the township administration jurisdiction, in Ningbo, to inform health policies and practices in China and other countries.

Results

In 2014, 49% (3412/7013) of adults older than 60 years of age on the intervention street were diagnosed with one of the four chronic diseases included in the chronic disease management system; the proportion was similar on the non-intervention street (50%, 2753/5480). During October 2014-March 2015, 1338 of 7013 (19%, 95% CI: 18%−20%) adults aged 60 years and older living on the intervention street received the seasonal influenza vaccine. Among adults 60 years and older living on the non-intervention street, 20 of 5500 (0.4%, 95% CI: 0.2%−0.6%) received the seasonal influenza vaccine (Fig. 1), a significantly lower proportion than on the intervention street ($p<0.01$). Post-intervention, vaccination coverage among adults 60 years and older with chronic diseases on the intervention street was 26% (95% CI: 24%−27%) which was significantly higher than the vaccination coverage among older adults with chronic diseases on the non-intervention street (0.3%, 95% CI: 0.1%−0.6%, $p<0.01$) (Table 1).

Among the 1338 vaccinated adults aged 60 years and older in the intervention group, 1307 (98%) stated that their main reason for vaccination was receiving a C-HCW recommendation. Further, 90% of the vaccinated adults 60 years and older from the intervention group received their vaccination at a temporary clinic, and 53% paid for their vaccine out-of-pocket (Table 1).

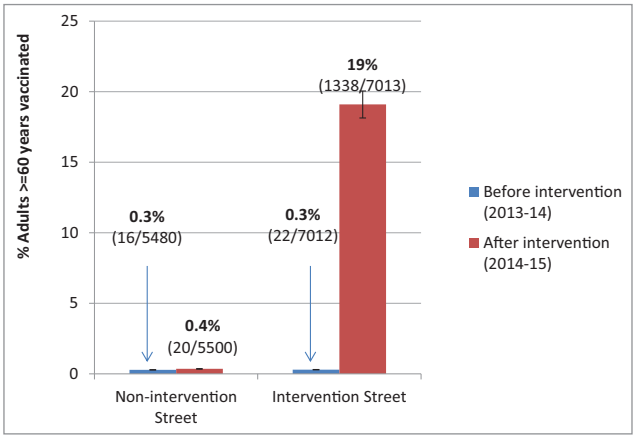

Figure 1. Seasonal influenza vaccine coverage among older adults on both the intervention and control streets, pre- and post- intervention, Ningbo, 2013–2015. This figure shows the comparison of seasonal influenza vaccine coverage among older adults ≥ 60 years on both the intervention street and the control street in two time frames, pre-intervention and post-intervention. The blue bars show vaccine coverage before the intervention on both streets. The red bars show the seasonal influenza vaccine coverage after the intervention on both streets. The 95% Confidence Intervals for the vaccine coverage are displayed with error bars.

Among 200 approached, 150 unvaccinated older adults from the intervention street completed a follow-up interview in April 2016 (response rate = 75%). When asked the main reasons they chose not to get vaccinated in the prior influenza season, 39% stated they were healthy and did not need vaccination, 24% reported not trusting their HCW's recommendation, 17% stated not knowing where to get vaccinated, and 9% cited cost as a barrier. The average cost of the seasonal influenza vaccine in Ningbo vaccination clinics in 2014–15 was 10 USD.

Discussion

Requiring community health care workers (C-HCWs) to recommend seasonal influenza vaccination during routine chronic disease follow-up visits for older adults, combined with increasing temporary vaccination sites in the vicinity, significantly increased influenza vaccine coverage among targeted older adults in Ningbo, China. Remaining barriers to vaccination included older adults' perception that healthy adults would not benefit from vaccination, not trusting the HCW recommendation for vaccination, and not knowing where to get vaccinated.

Compared with the traditional, often costly mass media promotion of vaccination which has been associated with limited impact on vaccine coverage rates,[8] dialogue-based health education during routine chronic disease follow-up visits can be tailored to the individual, and may be more effective. Further, studies in many countries have demonstrated the impact of the HCW recommendation on a patient's willingness to get vaccinated.[9-11] Even in Ningbo, the vast majority of older adults interviewed prior to the intervention reported willingness to get vaccinated if they received a HCW recommendation for vaccination.

In this intervention, improving access to vaccination sites also facilitated vaccination among older adults without diagnosed chronic diseases on the intervention street. In prior studies, ready access to vaccination clinics has been identified as an important facilitator of vaccination,[12] and within this pilot, more than 9 out of 10 vaccinated older adults on the intervention street were vaccinated in a temporary clinic opened as part of the intervention. The total additional cost for opening the 14 temporary sites for vaccination was 7,572 USD.

Cost is a common barrier to influenza vaccination, especially in places were vaccination is not covered or subsidized by insurance.[13] Interestingly, among interviewed unvaccinated older adults on the intervention street, less than 10% listed cost as a major barrier to vaccination, and more than 50% of the vaccinated older adults paid for vaccine out-of-pocket. Further, although the employee medical insurance policy facilitating real-time payment for vaccine by insurance was launched in October 2014, vaccine coverage among older adults in the control group remained less than 1% during the 2014–15 influenza season. These findings suggest that cost is not the only barrier to vaccination, especially in economically developed areas such as Ningbo. In addition, new policies such as the employee medical insurance policy for the general public require time and publicity for successful implementation, and benefit from complementary vaccine promotion efforts.

One major challenge to vaccine promotion in Ningbo is mistrust of HCWs. Nearly one quarter of unvaccinated older

Table 1. Vaccination status of adults ≥60 years old on both the intervention and control streets, pre- and post- intervention, Ningbo, 2013–2015

	Before intervention (Oct 2013-Sep 2014)		After intervention (Oct 2014-Sep 2015)	
	Intervention street	Non-intervention street	Intervention street	Non-intervention street
Adults ≥60 years of age	7012	5480	7013	5500
# received seasonal influenza vaccine (% all older adults)*	22 (0.3)	16 (0.3)	1338 (19)	20 (0.4)
# stating reason for vaccination was C-HCW** recommendation (% vaccinated older adults)	0	0	1307 (98)	0
Vaccine payment method (% vaccinated older adults)				
Personal health insurance	0	0	343 (26)	7 (35)
Family health insurance	0	0	280 (21)	2 (10)
Cash payment	22 (100)	16 (100)	715 (53)	11 (55)
# with chronic diseases*** (% all older adults)	3412 (49)	2753 (50)	3651(52)	2874 (52)
# received seasonal influenza vaccine (% adults with chronic diseases)	12 (0.4)	9 (0.3)	934 (26)	8 (0.3)

*Older adults are adults ≥60 years of age.
**C-HCW: Community Health Care Worker.
***Chronic diseases include diagnosed hypertension, diabetes, cerebrovascular disease and cancer.

adults on the intervention street reported not trusting their HCW's recommendation for vaccination. Increasing patient trust for HCWs in China will likely require numerous systemic interventions. In the short-term, several simple efforts may increase patients' willingness to accept their HCWs' recommendations. For example, the interviews with unvaccinated older adults in Ningbo suggested the importance of explaining why vaccination is important even among otherwise healthy adults, the benefits of vaccination, and where and when adults can get vaccinated. To more effectively promote vaccination in the future, one required next step is to develop and evaluate a standard recommendation for seasonal influenza vaccination for C-HCWs to routinely make during all chronic disease management visits. The recommendation should include a clear rationale for vaccination in addition to the practical logistics of when and where to get vaccinated.

This study is subject to at least three limitations. First, we did not observe C-HCWs making their recommendations for vaccination, and therefore we were unable to evaluate the quality of the recommendation. Among the unvaccinated older adults interviewed, nearly one in five stated the main reason they did not get vaccinated was not knowing where to get vaccinated, suggesting that not all C-HCWs effectively communicated the location of the temporary vaccination clinics. It is possible that our community intervention would have had greater impact if C-HCWs' recommendations were standardized to include both the rationale and the practical logistics for vaccination. Second, we are unable to determine how effective the C-HCW recommendation would have been without the increased access to neighborhood vaccination clinics. Third, the coverage data by specific chronic conditions were not available, and therefore we were unable to determine the effect of the intervention among older adults with different chronic conditions.

Conclusions

Our study found that requiring C-HCWs to recommend seasonal influenza vaccination to older adults with chronic diseases through the routine chronic disease management system, in addition to increasing access to vaccination clinics, increased seasonal influenza vaccine coverage among older adults in Ningbo, China. Although numerous additional interventions are required to substantially increase vaccine coverage among older adults in China, our study suggests that the C-HCW's recommendation for vaccination during routine chronic disease follow-up can serve as an effective component of a vaccine promotion strategy among high risk adults. Therefore, we recommend educating clinicians and public health workers about the importance of annual seasonal influenza vaccination for high risk groups in China, and increasing access to vaccination services for adults in China, including access to vaccines for healthcare workers themselves.

Materials and methods

Study site

Ningbo City, located on the southeast coast of China, has a population of 7.83 million registered residents and approximately 2.75 million migrants; per capita disposable income in 2015 was 6896 USD.[14] Typically, there are two influenza seasons in Ningbo each year, a winter-spring (November-April) and a summer season (June-August). Prior to this initiative, seasonal influenza vaccines in Ningbo were provided in 179 vaccination clinics within local community health centers that are used primarily for pediatric immunizations included in the national Expanded Program on Immunization, and in 5 adult immunization clinics. Since 2010, Ningbo's local employee health insurance has covered seasonal influenza vaccination; however, reimbursement procedures for vaccination of employees' family members are complicated. Each year, Ningbo CDC promotes vaccination prior to the peak winter influenza season through newspaper, internet and television. Still, seasonal influenza vaccine coverage among adults aged 60 years and older in Ningbo remains less than 1%.

Prior to the 2014–15 winter influenza season, Ningbo CDC conducted knowledge, attitude and practice interviews regarding seasonal influenza and influenza vaccination among adults 60 years of age and older within three senior centers. Among those interviewed, 78% (296/379) stated willingness to get vaccinated if they received a healthcare worker recommendation for vaccination, and 80% (301/377) listed community health care centers as the most convenient location for vaccination (unpublished results).

Study intervention

Prior to the 2014–15 winter influenza season, Ningbo CDC selected two streets, one intervention and one control, in Yinzhou District to implement and evaluate interventions to increase seasonal influenza vaccination among adults aged 60 years and older. For the intervention street, Ningbo CDC a) trained 113 C-HCWs in October 2014, including those responsible for NCD management on the intervention street; topics included epidemiology and disease burden of influenza illness, seasonal influenza vaccine effectiveness among older adults with NCDs, and influenza vaccine policy in China; b) required C-HCWs at intervention sites to recommend seasonal influenza vaccination to all adults aged 60 years and older with NCDs during quarterly routine NCD follow-up visits in October-December 2014, and to inform patients where to get vaccinated; c) opened 14 temporary vaccination clinics from October-December 2014 that offered seasonal influenza vaccine on the intervention street, adding to the one permanent vaccination clinic pre-intervention.

Outcomes measured

We assessed the seasonal influenza vaccine coverage, pre- and post-intervention, in March 2015, among adults aged 60 years and older on both the intervention and control streets by reviewing the hard copy records of seasonal influenza vaccination at all vaccination clinics serving adults on both the intervention and non-intervention streets. In April 2016, Ningbo CDC returned to the intervention street to contact a random sample of 200 older adults who did not get vaccinated during the prior influenza season to interview them about reasons they chose not to get vaccinated.

Statistical analysis

Descriptive statistical methods were used to calculate vaccination coverage and the proportions of respondents selecting reasons for following or not following the recommendation for vaccination. Chi-square test was used to compare vaccination coverage between the intervention and control groups. Statistical analyses were performed by SPSS 21.0. Statistical tests were all 2-sided. The level of significance was defined as $p<0.05$ for all statistical tests.

Ethics statement

Ningbo CDC obtained Institutional Review Board approval to conduct this project, and the United States Centers for Disease Control and Prevention was determined to be non-engaged. All participating older adults gave verbal informed consent to be interviewed. Written informed consent was not obtained because the project was determined to be a public health evaluation in which the risks associated with participating in a ten minute oral interview on reasons for getting or not getting vaccinated were minimal.

Disclosure of potential conflicts of interest

The authors declare that they have no competing interests.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Authorship

H.D., B.Y., C.G., Y.S. and S.Z. conceived of and designed the study; E.C., J. C., L.F., J.Z., H.Y., H.D. coordinated and supervised the study; B.Y. and X. L. assisted in data collection, and analyzed the data; S.Z., C.G. and Y.S. wrote the draft of the manuscript; B.Y. and H.D. helped revise drafts of the manuscript. All authors have seen and approved the final manuscript, and have contributed significantly to the work.

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