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REVIEW

# Perceived concern about the new strain of the influenza and obtaining the vaccine in China, Japan and South Korea

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**Abstract** This study compares the factors, which influence individuals from the countries of China, Japan and South Korea to obtain any type of influenza vaccines and their perceived concerns about the new strain of the influenza - pandemic (H1N1) 2009. The data analyzed was from the East Asian Social Survey (EASS), Cross-National Survey Data Sets: Health and Society in East Asia, 2010 (ICPSR 34608) ( $N=7938$ ). The results of this study suggest that individuals who are concerned about the new strain of influenza are more likely to have obtained influenza vaccine. In these countries, perceived concerns may be directly related to vaccine-related behaviors. The results of this study also indicate that there are variations within each country regarding as to why individuals do or do not obtain the influenza vaccine. Over all, this project provides new insights about the acquisition of the influenza vaccine within China, Japan and South Korea, which will be useful for medical practice within these countries and future research.

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## Introduction

It is estimated that 5–10% of adults and 20–30% of children are infected by influenza annually, resulting in 250,000–500,000 deaths around the world [1]. Influenza vaccines are important in order to control epidemics and pandemics of influenza [2]. Unfortunately, there are disparities regarding influenza vaccine coverage within and across countries [3,4]. Along with the issues of accessibility and cost, other barriers to obtaining influenza vaccines include lack of time, interest and individual beliefs about the likelihood of being infected [3]. To increase influenza vaccine coverage, it is important to examine social factors and perceptions related to influenza vaccines. This study focused on three Asian countries: China, Japan and South Korea. These countries are among the most populous Asian countries and despite being geographically close, they report notable differences in statistics regarding influenza vaccination profiles.

In China, the average vaccination rate for influenza was 9% in 2011. This is much lower than the average rates in more developed countries [5]. The influenza vaccine is not covered under the Expanded Program on Immunization (EPI), and individuals who would like to receive an influenza vaccine have to pay the full cost out-of-pocket [6]. As a result, the majority of people are not willing to receive non-EPI covered vaccines, leaving a large portion of the population unprotected from influenza [6].

In Japan, which has universal health insurance, influenza vaccines are not covered by insurance [7]. However, some individuals (e.g. individuals

aged 65 or older—the eligibility criteria vary across municipalities) are eligible to receive fee waivers [7]. Japan had the schoolchild vaccine program to control influenza from 1962 to 1994, which did contribute to decreased mortality from influenza in children [8]. More recently, however, parents of children under the age of 13 are concerned about the adverse effects of influenza vaccines, thus lowering the number of children in this age range from getting the vaccine [9]. Among adults age 20–69 years old, common reasons to not obtain the influenza vaccine include lack of time and perceived low susceptibility to influenza [10]. There is also an issue of mistrust in vaccination recommendations and side effects [11]. The influenza vaccine coverage rate in Japan in 2010/2011 was 38.6% [12].

In South Korea, a National Immunization Program (NIP) provides free influenza vaccine to priority groups, such as individuals aged 65 or older, individuals in poverty, individuals with disabilities, and soldiers, for seasonal influenza vaccination [13]. The highest percentage of the South Korean population recorded to have obtained flu vaccines was 43.6% between 2008 and 2012 [13]. Because the influenza vaccination coverage among the individuals in the age group of 50–64 years tends to be low, it has been recommended that the availability of the influenza vaccine at the workplace needs to be improved [14].

The purpose of this study is to compare the factors influencing the procurement of influenza vaccines and the perceived concerns about the new strain of the influenza in China, Japan and South Korea. Because there are significant

variations in influenza vaccine coverage across these countries, this comparison will be helpful to better understand how to promote influenza vaccines among target populations within these countries.

## Methods

### Data

Data used in this study came from the East Asian Social Survey (EASS), Cross-National Survey Data Sets: Health and Society in East Asia, 2010 (ICPSR 34608). The cross-sectional retrospective data were collected from nationally representative samples through self-administered surveys and/or interviews in 2010. The detailed information about the study, including data collection procedures, is available at <http://www.eassda.org/>. The original collector of the data obtained ethical approval. The analysis of publicly available secondary data from the ICPSR does not require IRB review. The original collector of the data, ICPSR, and the relevant

funding agency bear no responsibility for the use of the data or for interpretations or inferences based upon such uses.

### Measures

#### Vaccinated against influenza

Participants were asked whether they received any type of influenza vaccines in the past year (2009) when seasonal and H1N1 influenza vaccines were available: "Were you vaccinated against influenza (of any type) during the last 12 months?"

#### Concern about the new strain of influenza

Participants were asked how much they were concerned about the new strain of influenza (the 2009 pandemic H1N1 strain) when there was pandemic in the past year using a 4-point Likert scale (1 = Very much, 4 = Not at all): "How much were you concerned about the new strain of influenza outbreak among people in 2009?"

#### Physical and mental health

Physical and mental health status was included in analysis because health status could be linked

**Table 1** Socio-demographic characteristics of participants, rate of being vaccinated against influenza and levels of concern about the new strain of influenza.

	Total (N = 7938)	China (n = 3866)	Japan (n = 2496)	South Korea (n = 1576)	p-Value <sup>a</sup>	F
<b>Frequency (%)</b>						
Male	3770 (47.5)	1872 (48.4)	1154 (46.2)	744 (47.2)	N.S.	
Married	5858 (73.8)	3061 (79.2)	1803 (72.2)	994 (63.1)	<0.01	
Employed	4881 (61.5)	2433 (62.9)	1505 (60.3)	943 (59.8)	<0.05	
Vaccinated against influenza	1863 (23.5)	399 (10.3)	976 (39.1)	488 (31.0)	<0.01	
<b>Mean (SD)</b>						
Age	48.82 (16.58)	47.13 (15.60)	53.70 (16.98)	45.20 (16.56)	<0.01	172.65
Age range	18–96	18–96	20–89	18–92		
Education (years of schooling)	10.47 (4.40)	8.50 (4.52)	12.63 (2.49)	11.89 (4.32)	<0.01	955.69
Physical functioning <sup>b</sup>	83.04 (28.09)	82.75 (28.30)	86.68 (23.68)	78.04 (32.76)	<0.01	46.44
Mental health <sup>b</sup>	69.46 (21.34)	71.98 (20.62)	68.51 (20.30)	64.79 (23.63)	<0.01	68.16
Levels of concern about the new strain of influenza <sup>c</sup>	2.15 (0.93)	2.13 (0.96)	2.23 (0.85)	2.11 (0.98)	<0.01	11.20

No. (%) or mean (SD). N.S. – not significant.

F – F-statistic

<sup>a</sup> p-Value denotes significance from Pearson's Chi-square tests between categorical variables (for cell size  $\geq 5$  only), and ANOVA tests for continuous variables.

<sup>b</sup> Higher scores indicate better health.

<sup>c</sup> Lower scores indicate higher levels of concerns.

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to vaccination coverage [15]. SF-12 uses a five point Likert scale to measure physical and mental health functioning and well-being during the past four weeks [16]. The SF-12 produces two composite scores, physical health composite scale (PCS) and mental health composite scale (MCS), with a possible score range of 0–100 [17]. Higher scores indicate better health [18].

**Socio-demographic characteristics**

Socio-economic characteristics included were age, sex, marital status, education (years of schooling) and employment status.

**Data analysis**

Data were analyzed using SPSS (version 22). Descriptive statistics (frequency and percentage, or mean and standard deviation) were used to describe the distribution of the dependent and independent variables. Comparisons were conducted using Pearson’s Chi-square tests for categorical variables and ANOVA tests for continuous variables. Logistic regression analyses were conducted separately for China, Japan and South Korea to predict whether being vaccinated against influenza (a dependent variable) is associated with independent variables including age, education, sex (male), marital status (socio-demographic characteristics), and physical and mental health. Multiple linear regression analyses were conducted separately for China, Japan and South Korea to predict the levels of concern about the new strain of influenza (a dependent variable) with the same independent variables. Factors which predict concern about the new strain of influenza were examined because previous studies suggested perceptions or beliefs would affect influenza vaccination [3,10].

**Results**

Table 1 describes socio-demographic characteristics of participants (N=7938). Japanese participants reported the highest percentage of influenza vaccination (n=976, 39.1%), followed by Korean participants (n=488, 31.0%) and Chinese participants (n=399, 10.3%). Japanese participants were less likely to be concerned about the new strain of influenza (mean=2.23, SD=0.85) than Chinese participants (mean=2.13, SD=0.96) and Korean participants (mean=2.11, SD=0.98).

Table 2 presents the predictors of influenza vaccination by country. In China, higher levels of

Table 2 Socio-economic predictors of obtaining influenza vaccine.

	China			Japan			Korea								
	B	S.E.	Wald	Sig.	Odds ratio	B	S.E.	Wald	Sig.	Odds ratio	B	S.E.	Wald	Sig.	Odds ratio
Age	-0.02	0.004	16.57	<0.01	0.98	0.02	0.003	35.76	<0.01	1.02	0.37	0.01	53.74	<0.01	1.04
Education	0.08	0.01	28.39	<0.01	1.08	0.04	0.02	4.95	<0.05	1.04	-0.04	0.02	4.19	<0.05	0.96
Male	0.16	0.11	2.09	N.S.	1.18	0.39	0.09	19.37	<0.01	1.47	-0.02	0.13	0.01	N.S.	0.99
Married	0.21	-.13	2.57	N.S.	1.23	-0.15	0.10	2.19	N.S.	0.87	0.20	0.14	2.28	N.S.	1.23
Employed	0.29	0.12	5.89	<0.05	1.34	0.21	0.10	4.71	<0.05	1.24	0.42	0.13	10.55	<0.01	1.52
Physical functioning <sup>a</sup>	-0.004	0.003	2.53	N.S.	1.00	-0.001	0.002	0.58	N.S.	1.00	-0.004	0.002	2.71	N.S.	1.00
Mental health <sup>a</sup>	0.01	0.003	2.50	N.S.	1.01	0.003	0.002	2.03	N.S.	1.00	0.01	0.003	6.95	<0.01	1.01
(constant)	-2/32	0.40	33.22	<0.01	0.10	-2.38	0.40	35.76	<0.01	0.09	-2.54	0.48	27.69	<0.01	0.08
<b>Model fit</b>															
-2 Log Likelihood															
Chi-square	2437.65					3170.98					1702.38				
Significance	94.84					101.38					231.21				
	<0.01					<0.01					<0.01				

Logistic regression. N.S. – not significant. B – coefficients in log-odds units. S.E. – standard errors. Wald – Wald chi-square value. Sig. – 2-tailed p-Value. Odds ratios are the exponentiation of the coefficients.  
<sup>a</sup> Higher scores indicate better health.

**Table 3** Predictors of concern regarding the new strain of influenza<sup>a</sup>

	China		Japan		Korea	
	$\beta$	<i>p</i> -Value	$\beta$	<i>p</i> -Value	$\beta$	<i>p</i> -Value
Age	0.003	<0.05	0.01	<0.01	0.01	<0.01
Education	-0.06	<0.01	0.002	N.S.	-0.01	N.S.
Male	-0.06	N.S.	0.27	<0.01	0.38	<0.01
Married	-0.21	<0.01	-0.37	<0.01	-0.34	<0.01
Employed	-0.02	N.S.	0.07	N.S.	-0.12	<0.05
Vaccinated	-0.41	<0.01	-0.36	<0.01	-0.25	<0.01
Physical functioning <sup>b</sup>	-0.001	N.S.	0.00	N.S.	0.001	N.S.
Mental health <sup>b</sup>	-0.002	<0.01	0.002	<0.05	0.001	N.S.
(Constant)	2.94	<0.01	2.01	<0.01	1.98	<0.01
<i>R</i> <sup>2</sup>	0.13		0.12		0.28	
<i>F</i>	69.78		39.88		16.43	
<i>p</i> -Value	<0.01		<0.01		<0.01	

N.S. – not significant. *B* – unstandardized coefficient. *R*<sup>2</sup> – *R*-square. *F* – *F* statistic.

<sup>a</sup> Lower scores indicate higher levels of concerns.

<sup>b</sup> Higher scores indicate better health.

education and employment were associated with being vaccinated, while older age was related to not being vaccinated. In Japan, older age, higher levels of education, being male and employment were associated with being vaccinated. In Korea, older age and employment were related to being vaccinated, while participants who had higher levels of education were less likely to be vaccinated.

Table 3 shows predictors of concern regarding the new strain of influenza. In all countries, participants who were married or vaccinated were more likely to be concerned about the new strain of influenza than those who were not married or not vaccinated. Older age was associated with being less concerned in all three countries. Additionally, higher levels of education were related to higher levels of concerns in China, but there was no significant relationship between the two variables Japan and Korea. Better mental health was associated with higher levels of concerns in China but the relationship was opposite in Japan.

## Discussion

This study examined factors related to vaccines against influenza and the perceived concerns about the new strain of the influenza in China, Japan and South Korea. A previous US-based study suggests that high level of concern about the pandemic of influenza is not necessarily related to perceived importance of pandemic vaccines [19]. Yet, the results of the current study suggest that individuals who are concerned about the new strain of

influenza are more likely to have obtained influenza vaccine in all three countries. In these countries, perceived concerns are likely to be related to vaccine-related behaviors.

The results of this study also indicate that there are some country variations regarding influenza vaccination. Unlike Japan and South Korea, where there is financial assistance for older people to obtain influenza vaccines, China does not have such a policy, and as the results of the study suggest, older people are less likely to be vaccinated in China. It is important to develop policy to promote influenza vaccines in China especially because influenza poses the highest medical risk to the elderly population. In addition, the impact of mental health on levels of concerns about the new strain of influenza was opposite in China and Japan. The results in Japan may be supported by the general trend that people who have good mental health may be less concerned about health-related issues. In any case, little is known about how mental health affects influenza vaccine related behaviors. Future research is necessary to examine the mechanisms linking mental health and vaccinations. Furthermore, male sex was associated with a higher possibility of being vaccinated in Japan. Potential barriers to influenza vaccination that Japanese women may experience need to be identified.

There is limited information to determine why higher levels of education were associated with lower likelihood of being vaccinated in South Korea, while employment was related to higher likelihood of being vaccinated. One potential explanation is



that educated people in South Korea may not trust safety and value of influenza vaccines. Public trust in vaccines is very important to ensure public health [20]. Future research should examine levels of trust in vaccines in South Korea as well as other countries.

While this study contributes to increased knowledge about socio-demographic factors and influenza vaccines in China, Japan and South Korea, there are some limitations. The data are cross sectional and thus limited to analyze causal directions between variables. There is no information about how many participants were eligible for free vaccines in these countries. Treating age as a continuous measure may not be appropriate because the percentage of individuals who are vaccinated may depend on age groups. However, age was treated as a continuous measure because there is no information about the specific age cut-off points in these countries, which may differentiate the proportions of vaccinated individuals. There is potential for misclassification of vaccination status due to self-report. Since the questionnaire focused more on chronic non-communicable diseases rather than influenza, the information related to influenza is limited.

While the international response is important to control influenza outbreaks and prevention, country specific factors need to be considered for effective prevention strategies. For example, while the primary target population to promote influenza vaccination would be older adults in China, the promotion and education efforts in Japan would need to target women. Despite the limitations, this project provides new insights about influenza vaccines in China, Japan and South Korea, which can be useful for practice and future research.

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## Competing interests

None declared.

## Ethical approval

Not required.

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