Journal of Infection and Public Health xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

Journal of Infection and Public Health

journal homepage: http://www.elsevier.com/locate/jiph

# Public preventive awareness and preventive behaviors during a major influenza epidemic in Fukui, Japan

Shintoku Takahashi[a,*], Kazuhiro Sato[a], Yukinori Kusaka[a], Akihito Hagihara[b]

[a] Division of Environmental Health, Department of International and Social Medicine, Faculty of Medical Sciences, University of Fukui, Fukui 910-1193, Japan
[b] Department of Health Communication, Graduate School of Medicine, Kyushu University, Fukuoka 812-8582, Japan

ARTICLE INFO

*Article history:*
Received 20 August 2016
Received in revised form 12 April 2017
Accepted 28 April 2017

*Keywords:*
Infection
Influenza
Epidemic
Preventive awareness
Preventive behavior

ABSTRACT

*Background:* As an influenza epidemic poses a serious public health threat, it is important for the public to adopt behaviors that effectively prevent influenza infection.
*Methods:* In the winter of 2009, by using a structured questionnaire, we conducted an Internet survey with respect to residents (n = 2788) in Fukui prefecture, Japan. The main aim is to obtain information about effective prevention, factors related to preventive awareness and behaviors during the influenza epidemic. A factor analysis and linear regression models were used in the analysis.
*Results:* Three types of preventive awareness were identified by factor analysis: "avoidance of influenza infection," "awareness of the benefits of mask use," and "awareness of the need for a rapid diagnosis." Gender, age, residence, being medical person and being vaccinated were related to these preventive awareness and behaviors. Avoidance of influenza Infection was related to all preventive behavior, awareness of the benefits of mask use was related to hand disinfectant use, and awareness of the need for a rapid diagnosis was related to avoidance of face touch, gargling and attention to health care, respectively.
*Conclusion:* Three types of preventive awareness during the influenza epidemic were emerged, and were related to preventive behaviors against influenza infection.


## Introduction

In the winter of 2009, the pandemic (H1N1) influenza virus caused a massive outbreak of disease in Japan. In Fukui Prefecture, the prefectural government issued an "influenza warning" on October 28, 2009, as the number of influenza patients per sentinel was 14.00 from October 19 to 25. On November 18, it issued an "influenza alert" as the number of patients per sentinel between November 9 and 15 was 32.16. From November 23 to 29, the number of patients per sentinel climbed to 95.44, which was the highest morbidity in all prefectures that winter. From February 15 to February 21, 2010, the number of patients per sentinel decreased to 5.19, and, on February 24, the influenza alert was lifted [1,2].

Compared with other countries where pandemic (H1N1) influenza caused outbreaks of similar size, Japan was unique because of its lower mortality rate [3]. As of November 6, 2009, the reported mortality rate (deaths per million individuals) was 0.2 in Japan, which was much lower than those in Canada (2.8), the UK (2.2), Mexico (2.9), the USA (3.3), South Africa (1.8), Argentina (14.6), Australia (8.6), Brazil (7.0), Chile (8.1), and New Zealand (4.4) [4]. By the time the pandemic (H1N1) was over, 198 deaths had occurred in Japan, including two deaths in Fukui Prefecture, by March 23, 2010 [1,2].

Public awareness and behavioral practices conducive to the prevention of influenza infection have been studied by several groups. However, the awareness of medical students in Karachi, Pakistan regarding disease transmission, preventive measures, vaccinations, and available treatment was inadequate with respect to H1N1 [5]. Health messages delivered through various media, especially television, were effective in informing the public of disease-related prevention measures during a developing influenza pandemic along the Mississippi Gulf Coast, USA [6]. Residents of Shuangqiao District, Chengde, China lacked comprehensive knowl-

* Corresponding author at: 23-3 Matsuoka-shimoaizuki, Eiheiji-cho, Yoshida-gun, Fukui Prefecture 910-1193, Japan, Division of Environmental Health, Department of International and Social Medicine, Faculty of Medical Sciences, University of Fukui. Fax: +81 776 61 8107.
*E-mail address:* tkhssntk@mail.goo.ne.jp (S. Takahashi).

http://dx.doi.org/10.1016/j.jiph.2017.04.002

edge about influenza A (H1N1), and specific health education was, therefore, needed [7]. Most of the many reports on influenza epidemics are based on government statistics, and little is known about the level of preventive awareness and/or about the most effective preventive practices in relation to an influenza infection in the general population.

Dr. Koji Omi pointed out that there are three explanations for why pandemic (H1N1) influenza resulted in a small number of casualties in Japan [8]: (i) school was suspended across a wide geographical area, particularly at the early stage of the outbreak; (ii) antiviral drugs were administered to a large proportion of infected individuals; and (iii) public awareness and personal hygiene, especially regular hand-washing, were promoted. This study focuses on the third reason. Specifically, we evaluated the relationship between a citizen's personal attributes and his/her preventive awareness and behavior during an influenza outbreak.

## Material and methods

### *Study design and ethics*

This was a cross-sectional online survey. This study was approved by the Ethics Committee of the University of Fukui.

### *Study period*

The study was conducted from October 9, 2009 to January 6, 2010.

### *Representativeness*

It has been reported that almost all Japanese individuals know their own blood type [9]. Thus, making use of this characteristics, we determined the blood types of participants based on their responses to the questionnaire. To assess the representativeness of the sample, we compared the prevalence of blood types in study subjects with national prevalence.

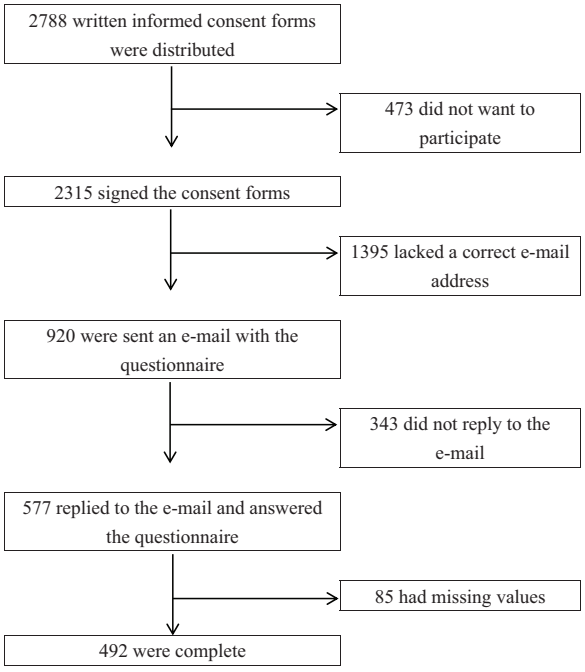


**Fig. 1.** Study participant selection.

### *Subject recruitment*

Fig. 1 depicts the subject recruitment process. Written informed consent forms regarding participation in the survey were distributed to 2788 people, including Fukui prefectural government members and officials and students of Fukui University (Fukui Prefecture). During the same period, 2315 signed consent forms were returned. These individuals were asked to provide their e-mail address for an Internet survey.

On November 17, 2009, the 920 individuals (39.7%) who had provided demographic information were sent a questionnaire regarding their preventive awareness level and behaviors during an influenza outbreak. The time required to answer all of the questionnaire items was approximately 10 min. Among the 577 (24.9%) returned questionnaires, 492 (21.3%) were complete.

### *Questionnaire items*

Questions addressing three domains were included in the Internet survey: (i) demographic characteristics and influenza vaccination and infection history; (ii) preventive awareness of influenza infection; and (iii) preventive behaviors adopted to avoid influenza infection. Demographic information and data on influenza vaccination and infection included sex (male, female), address (Fukui City, others), whether respondents were living with children under the age of 18 years (yes, no), age, occupation (medical, non-medical), prior experience with influenza infection (yes, no), blood type (ABO expression), e-mail address, vaccination in the past 3 months (yes, no), diagnosis of influenza infection in the past 3 months (yes, no), and family history of influenza diagnosis in the past 3 months (yes, no).

Items included in the section addressing preventive awareness of influenza infection evaluated how active a respondent was in taking measures to avoid either the influenza infection or spreading the influenza virus. Responses were provided on a scale from 0 ("not at all") to 10 ("very much") and were used in a factor analysis. Items addressing preventive behaviors to avoid influenza infection evaluated the extent to which respondents practiced six types of preventive behavior in their daily lives: hand-washing, using hand disinfectant, avoiding contact with their face, gargling, attending to healthcare, and collecting flu-related information. Responses were provided on a scale from 0 ("not at all") to 10 ("very much").

### *Analysis*

The aim of this study was to determine how the personal attributes of Japanese citizens were related to their level of preventive awareness and to the preventive behaviors they adopted during the pandemic (H1N1) influenza outbreak. To these ends, we performed three analyses. First, factor analyses with varimax rotation and promax rotation were performed using the responses to the nine items included in the section addressing preventive awareness of influenza infection. Factor analysis is a statistical method used to describe the variability among observed, correlated variables in terms of fewer, unobserved variables, called factors [10]. Varimax and promax are commonly available orthogonal and oblique methods, respectively. Orthogonal rotations produce factors that are uncorrelated, while oblique methods allow the factors to correlate [11]. In the study, we tried both methods, and a Heywood case was detected in varimax rotation. Thus, promax rotation was adopted in the analysis. The following three factors were identified: "avoidance of influenza infection," "awareness of the benefits of mask use," and "awareness of the need for a rapid diagnosis." By summing the item scores for each of the three factors, a factor score with a range of 0–30 was calculated.

Please cite this article in press as: Takahashi S, et al. Public preventive awareness and preventive behaviors during a major influenza epidemic in Fukui, Japan. J Infect Public Health (2017), http://dx.doi.org/10.1016/j.jiph.2017.04.002