International Journal of Community Medicine and Public Health
Anuja U et al. Int J Community Med Public Health. 2017 Feb;4(2):428-432
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: http://dx.doi.org/10.18203/2394-6040.ijcmph20170267

Original Research Article

Seroconversion following H1N1 influenza vaccination among health care personnel in South Kerala, India

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Received: 27 November 2016
Accepted: 23 December 2016

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ABSTRACT

Background: Health care workers were prioritized by World Health Organization (WHO) for H1N1 vaccination during 2009 swine influenza pandemic following which in Kerala, a total of 72,000 people mostly health care personnel were immunized with a single dose of inactivated split influenza monovalent H1N1 vaccine in 2010. The present study was carried out with the objective to find out the proportion of health care workers seroconverted in Kerala following H1N1 vaccination.
Methods: A cross-sectional study conducted in three districts of Kerala. Blood samples collected from 193 health staffs were analysed for H1N1 antibody titre 6 months following single dose of vaccination. Univariate analysis was done using proportions for qualitative variables.
Results: 99.5% of health staffs seroconverted following vaccination and none of them developed disease even after getting exposed to H1N1 cases thereafter.
Conclusions: Single dose of H1N1 vaccine is found to offer sufficient protection and should be recommended for health care workers. So all health care personnel shall consider H1N1 vaccination for their own protection.

Keywords: Health care workers, H1N1 vaccine, Swine influenza, Seroconversion, Vaccination

INTRODUCTION

Swine influenza, also known as 2009 H1N1 type A influenza, is caused by a "reassortant" virus which is a mix of genes from swine, bird, and human flu viruses. The disease is originally called Swine flu as the virus that causes the disease originated from the live pigs in which it evolved and later got transmitted to humans.[1] The virus causes a highly contagious acute respiratory disease in pigs which spreads by aerosols, through direct and indirect contact, and also by asymptomatic carrier pigs. Though transmission of swine influenza viruses to humans is uncommon, man can get the disease from pigs through contact with infected pigs or from environments contaminated with swine influenza viruses.[2] The symptoms of swine flu in humans are similar to those of influenza namely chills, sore throat, fever, severe headache, coughing, general discomfort and muscle pain.[3] Spread of disease in humans is mainly through coughing or sneezing and is contagious mostly during the first 5 days of the illness although some people can remain contagious for up to 10 days.[4] The present pandemic of H1N1 influenza had begun in Mexico in March 2009 which rampantly spread to different parts of the world. On June 11, 2009, the World Health Organization signalled the whole world regarding the arrival of a new global pandemic of novel Influenza A (H1N1) by raising the worldwide pandemic alert level to

Phase 6.[5] This was the first pandemic of the 21st century of phase 6 level as defined by the criteria of WHO .During that time more than 70 countries had reported cases of novel influenza A (H1N1)infection and on-going community level outbreaks of novel H1N1 influenza in different parts of the world. The pandemic in India started in August 2009 and the index cases were reported from Pune.[6] This epidemic spread to other parts of the country in a short time that India ranked 3rd. Among the most affected countries for cases and deaths of swine flu globally.[7] The disease was found to affect the younger population in the age group of 15-40 years hence affecting the working population of the country.[6] The highest number of cases in India were reported in 2009 (27,236), followed by 2010 (20,604) and 2012 (5,054 cases). The highest number of swine flu deaths in the country took place in 2011 (1,763), followed by 2009 (981) and 2012 (405).[8] World Health Organization considered vaccination as one of the most important primary preventative measures to reduce the disease burden associated with pandemic influenza A (H1N1) infection [9] Though several high risk groups were identified as the priority groups, healthcare providers were prioritized by the World Health Organization to be the first group for vaccination against influenza A (H1N1) to maintain the integrity of the health care system and to reduce nosocomial influenza A(H1N1)pdm09 transmission to and from vulnerable patients and informed all countries to immunize their healthcare workers as a first priority.[10] Following this in Kerala about 72,000 people, mostly hospital staffs including doctors, nurses and paramedical staff were immunized in 2010 with pandemic influenza vaccine known as Panenza vaccine manufactured by Sanofi Pasteur in France which is a monovalent vaccine containing inactivated split influenza antigens of A/California/7/2009 (H1N1)v-like strains. The vaccine was supplied by State health department given as single dose of intramuscular injection containing 0.5ml. Seroconversion rate in H1N1 vaccination is defined as the rate of patients with ≥4-fold increase in antibody titers against influenza A H1N1/09 after vaccination. Though H1N1 pandemic is currently under control, India still has ongoing outbreaks of H1N1 influenza. India had reported 937 cases and 218 deaths from swine flu in the year 2014. By mid-February 2015, the reported cases and deaths in 2015 had surpassed the previous numbers.[11] According to state Health Department's disease surveillance unit in Kerala, number of swine deaths in Kerala rose from 17 cases and three deaths in 2014 to 421 cases and 50 deaths within just six months of 2015.[12] Owing to the present situation existing in Kerala, it becomes essential to know about the immunity induced by pandemic influenza vaccine among health care providers in the state.

The present study is an attempt to find out the Seroconversion status of Health staffs in Kerala six months following vaccination against H1N1 with Pandemic Influenza vaccine in 2011.

METHODS

Study design and population

A hospital based cross sectional study was conducted to collect information regarding sero-conversion rates 6 months following H1N1 vaccination amongst health staffs. The study was conducted in three districts of Kerala namely Thiruvananthapuram, Kollam and Ernakulam from where most number of H1N1 cases were reported in the year. Data regarding the socio-demographic profile and H1N1 related activities were collected using a pre-tested structured questionnaire and the seroconversion statuses following vaccination were assessed by testing antibody titer in blood. Study lasted from May 2011 to September 2011. All health care personnel who had received single dose H1N1 vaccination during swine influenza pandemic in south Kerala constituted the study population. Data were collected from all General, District, and Taluk hospitals of Thiruvananthapuram, Kollam and Ernakulam districts. A total of 38 government hospitals were included and from each hospital, 5 health staffs who had taken H1N1 vaccination were recruited in random for the study. Finally193 health staffs immunized with H1N1 vaccine formed study subjects. Data were collected only after obtaining written informed consent from each of the study participant. From each willing participant 3-5 ml of blood were collected for serological analysis. Data regarding their socio-demographic factors and exposure to H1N1 cases were collected using a pre-tested structured questionnaire. Testing for antibody titer was done using ELISA. A monoclonal antibody (MAb) against influenza A Hemagglutinin protein (HP) to detect the antibodies against influenza.H1N1 Hemagglutinin HA protein- A/California/07/2009 was used for the assay. It was considered that wells with the antibodies should turn blue and was read as positive ELISA result as both anti-H1N1 primary antibody and the HRP-labelled (Horseradish Peroxidase) secondary antibody will bind to the well and will not wash away. HRP will oxidize the enzyme substrate, which will result in a blue color confirming the presence of antibodies. On the contrary wells without antibodies remain colorless and was considered as negative ELISA result.

Sample size estimation and sampling technique

Sampling technique adopted was Cluster sampling. All General hospitals, Taluk hospitals and District hospitals coming under government sector in Thiruvananthapuram, Kollam and Ernakulam districts were the primary sampling unit. This constituted a total of 38 government hospitals as study sites. Then five health staffs who had received H1N1 vaccination were randomly recruited from each of the study site resulting in a total of 193 study subjects.

Sample size estimation

Sample size was estimated using the formula $4pq/l^2$. Previous study showed that the overall effectiveness of single dose H1N1 pandemic influenza vaccine was 86%.[13] Considering the sero-conversion of 85% with α error of 5%, β error of 10% and design effect as 2, sample size required was found to be 142 to study the seroconversion status of pandemic influenza vaccine (Panenza vaccine). Health care providers who received the vaccine were recruited from the selected study sites.

Ethical consideration

Study protocol was submitted to the human ethical committee after attaining clearance from research committee. Study was commenced only after getting consent from the human ethical committee. Informed consent was also obtained from each of the study participants before collecting data. Procedures followed were in accordance with the ethical standards of the human ethical committee and Helsinki Declaration.

Statistical analysis

3-5ml blood were collected from 193 health staffs who had received vaccination which was later tested for antibody titer level using ELISA method. While analyzing data, univariate analysis was done using proportions for qualitative variables.

RESULTS

During the H1N1 influenza pandemic period, Government of Kerala provided pandemic H1N1 influenza vaccine free of cost to hospital care providers in Kerala. 193 Hospital staffs who had received single dose vaccine from government health facilities were studied. The investigators assessed seroconversion status among vaccine recipients.

Table 1: District wise general information regarding study participants.

Job category	Thiruvananthapuram		Kollam		Ernakulam		Total	
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Doctor	6	9.7	0	0	6	6.2	12	6.2
Nurse	28	45.2	17	48.6	46	47.9	91	47.2
Laboratory technician	13	21.0	11	31.4	12	12.5	36	18.6
Nursing assistant	4	6.5	3	8.6	18	18.8	25	13.0
Ward support staf	5	8.1	1	2.9	8	8.3	14	7.2
Others	6	9.7	3	8.6	6	6.2	15	7.8
Total	62	100.0	35	100.0	96	100.0	193	100.0

Table 2: District wise distribution of baseline data.

Variables	Thiruvananthapuram		Kollam		Ernakulam		Total	
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Age (years)								
21-30	12	19.4	9	25.7	21	21.9	42	21.8
31-40	19	30.6	7	20.0	24	25.0	50	25.9
41-50	24	38.7	15	42.9	31	32.3	70	36.3
51-60	7	11.3	4	11.4	20	20.8	31	16.0
Gender								
Males	13	21.0	8	22.9	16	16.7	37	9.2
Females	49	79.0	27	77.1	80	83.3	156	80.8
Residing								
Residing in Rural area	38	61.3	26	74.3	59	61.5	123	63.7
Residing in Urban area	24	38.7	9	25.7	37	38.5	70	36.3
Total	62		35		96		193	

The baseline characteristics of all the 193 participants are given in Table 1. Of 193 participants 49.7% (N=96) were recruited from Ernakulam district, 32.1% (N=62) from Thiruvananthapuram district and 18.13% (N=34) were from Kollam district. Vaccine recipients included all categories of hospital staffs. 47.2% (N=91) of nurses constituted nearly half of the study subjects followed by 18.6% (N=36) laboratory technicians. Doctors formed only 6.2% (N=12) of participants. 99.48% (N=192) of hospital staffs seroconverted and only one person (0.52%) remained as sero-negative in the study. 21.2% of vaccine recipients were involved in care of patients affected with H1N1 pandemic influenza of which 10.36% of health workers had confirmed exposure to H1N1 cases after vaccination whereas 19.68% of health workers had doubtful exposure to H1N1 cases from either inside or outside hospital but none of them developed H1N1 till date of study completion.

Table 3: Sero-conversion status of health care personnel in various districts.

ELISA result	Number of health care personnel various districts			
	Thiruvananthapuram	Kollam	Ernakulam	Total
ELISA positive	62	34	96	192
ELISA negative	0	1	0	1
Sero prevalence	100%	97.1%	100%	99.5%
Total	62	35	96	193

Table 4: Profile of H1N1 related activities after vaccination.

Involvement in H1N1 patient care activities	Thiruvananthapuram		Kollam		Ernakulam		Total	
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Involved in H1N1 patient care activities	16	25.8	6	17.14	19	19.79	41	21.2
Did not involve in H1N1 patient care activities	46	74.2	29	82.9	77	80.2	152	78.76
Exposed to H1N1 cases	13	20.96	2	5.71	5	5.2	20	10.36
Not Exposed to H1N1 cases	38	61.29	23	65.71	74	77.03	135	69.94
Not sure about H1N1 case exposure	11	17.74	10	28.57	17	17.7	38	19.68

DISCUSSION

Nearly half of the health care personnel who had received H1N1 vaccination in this study were staff nurse. This supported the finding given by Pandey et al who got similar results while looking into the profile of H1N1 vaccination among health workers.[14] A previous study on the acceptability of seasonal influenza vaccination revealed that the acceptance of vaccination in nurses was lowest among all healthcare workers.[15] A study of healthcare workers in Italy showed 31 per cent of nurses were willing to accept vaccination compared to 67 per cent of physicians.[16] Another study conducted in Hong Kong healthcare workers found that only 25 per cent of nurses were willing to accept influenza A (H1N1) vaccination compared to 47 per cent of doctors and 29 per cent of allied professionals.[17] Few more studies are available suggesting that vaccination acceptance rate is highest among physicians. [18-20] It was seen that the H1N1 vaccine induced protective antibodies developed within 1–2 weeks after administering a single dose of vaccine in the majority of healthy adults.[21-25] A clinical trial conducted in 207 frontline Health care personnel in October 2009 to evaluate the tolerability and immunogenicity of a single dose pH1N1 vaccine had shown protective HI antibody response in approximately 97% of vaccines by 14–21 days after vaccination. This is similar to the results given by the present study where 99% of health workers showed protective antibody titer.

CONCLUSION

The H1N1 vaccine acceptance during pandemic was good amongst nurses whereas the vaccine coverage was

low among category of doctors and paramedics. Our findings showed that health care providers responded well to single dose of pH1N1 vaccine in terms of sero-conversion and protection from H1N1 thereafter. All countries should immunize their health care workers as a priority group as they are extensively exposed to pandemic influenza infection.

ACKNOWLEDGEMENTS

The authors would like to express their special thanks to Rajiv Gandhi Centre for Biotechnology at Thiruvananthapuram for helping with the antibody titer estimation.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Human Ethics Committee

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Cite this article as: Anuja U, Rajasi R S, Ratheesh KH, VijayaKumar K, Fettil A. Seroconversion following H1N1 influenza vaccination among health care personnel in South Kerala, India. Int J Community Med Public Health 2017;4:428-32.