

CONSECUTIVE INFECTION WITH INFLUENZA A AND INFLUENZA B VIRUS AFTER  
DEVASTATING EARTHQUAKE IN DOLAKHA DISTRICT, NEPAL<sup>1</sup>\*Dr Abhiyan Gautam and <sup>2</sup>Surya Subedi<sup>1</sup>Kathmandu University, Nepal.<sup>2</sup>Trichandra Multiple Campus, Tribhuvan University, Nepal.

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## ABSTRACT

**Background:** The great earthquake of magnitude 7.8  $M_w$  hit on April 25, 2015 killed over 8000 people, injured more than 21,000 and many are missing. The great earthquake was followed by hundreds of aftershocks in which Dolakha was struck again by earthquake on 12 may with epicenter in Dolakha district with magnitude of 7.3  $M_w$  followed by hundreds of aftershocks in which about 87% houses were fully damaged. In Nepal outbreak of influenza usually occurs between December and March. After the devastating earthquake, outbreak of influenza occurred in February 2016 and they were confirmed as Influenza A ( $H_3N_2$ ) and influenza B. **Methods:** After local public health centre (PHC) reported the symptoms, medical team went and suspected it as influenza outbreak in first and second case. Investigation was made where the patients were suffering from common symptoms. Public awareness program was conducted immediately at different places. Samples were collected and dispatched to laboratory immediately which were subjected to reverse transcription PCR for sub-typing of influenza. **Result:** The first outbreak was prevalent in all age groups and the rate of transmission was high. No death was reported in this outbreak whereas Complications whereas three were suffered from pneumonia while one from bronchitis. The first outbreak was confirmed as ( $H_3N_2$ ). The second outbreak was only in children of age below 14. Among 300 children, 246 were suffered from infection. Symptoms were common in all children. No complications were seen beside general symptoms. It was confirmed as influenza B on lab diagnosis. **Conclusion:** Influenza can outbreak in disastrous area in epidemic influenza season. The transmission route is direct contact with infected person, use of person goods, sharing of room, space and by aerosols. If public awareness and care taken, it can be controlled.

**KEYWORDS:** Influenza, outbreak, earthquake, Dolakha, Nepal.

## 1. INTRODUCTION

The great earthquake of magnitude 7.8  $M_w$  hit on April 25, 2015 killed over 8000 people and injured more than 21,000. The earthquake triggered many dry landslides encompassing an avalanche on Mount Everest, Langtang valley in which hundreds were missing and thousands were homeless with entire village flattened with regular aftershocks at intervals of 15-20 minutes including one shock reaching magnitude 6.7 on April 26 with continued dry landslide on countryside.<sup>[1-4]</sup> Dolakha was adversely affected by 25 April earthquake, was struck again by earthquake on 12 may with epicenter in Dolakha district with magnitude of 7.3  $M_w$  followed by hundreds of aftershocks in which 50,284 houses were fully damaged and 305 houses were partially damaged.<sup>[5]</sup> Hundreds of people were living in field with no electricity, food and water. The congested living environment, poor sanitation, unhygienic practice, contaminated drinking water, pollution etc were prevalent so opted for high alert measures in view of a

possible epidemic outbreak in the district.<sup>[6]</sup> Many NGOs, INGOs has been working in this area regarding health, sanitation, disaster risk, social sector and humanitarian, agriculture, nutrition etc so an increase in incidence of communicable disease is reduced but not significantly. Children and elderly people were most affected by earthquake over the year due to various problem as well as immunity.

After disaster, the risk of outbreak of infectious disease like acute respiratory infections, water borne disease, vector borne disease, infections as a result of wound, injuries are major subject of concerned. Among these diseases, acute respiratory infections including influenza are most common that occurs after natural disaster.<sup>[7]</sup> There are limited articles regarding influenza outbreaks after natural disaster because of limited ability to confirm suspected cases.<sup>[8]</sup> Influenza virus is most common cause of acute respiratory diseases that are usually self-limited but can sometime lead to severe complications such as

pneumonia and influenza associated encephalopathy.<sup>[9]</sup> Human influenza are the viruses of orthomyxoviridae family which are segmented, negative-sense, single stranded RNA which spreads rapidly around the world as epidemics among which influenza A and B are more common while C causes mild infection<sup>[10, 11]</sup> Influenza A virus has unique capacity of undergoing mutation causing rapid change in antigenic characters. Studies regarding influenza associated mortality revealed that a higher impact was associated with influenza A (H3N2) than other seasonal viruses.<sup>[12]</sup>

Since, there are few publications on influenza outbreak after disaster, thus this study was aimed to study the prevalence of influenza virus, strategy of control in upcoming days if outbreak occurs.

## MATERIALS AND METHODS

### 1. Study areas

Dolakha district is situated on northern part of the central region of Nepal. It has a population of 186557 in accordance to census 2011 while after disaster it was found to be 280,874. Due to devastating earthquake 86.4% (50,284) houses fully damaged in which 175 people were died and about 1960 people were injured. 25 April earthquake cause widespread damage to the area while the second earthquake on 12 May led to severe damage but casualties in Dolakha is comparatively less because peoples were on tent due to first earthquake and schools and colleges were closed.

### 2. Outbreak investigation

Influenza virus causes sporadic infection and commonly and dramatically seen as local outbreak or widespread epidemics in most parts of the world. First the symptoms of influenza A was seen in the people attending local festival Bulung mela, in Dolakha, district in 2016/02/09. The patients suffering from flu like syndrome visited nearby health post and public health nurses and health assistant reported this case in district health office because 20-30 per day same cases were reported among which many of them school children. From district office the medical team went there and suspected the outbreak of influenza on 2016/02/11. Throat swab and nasopharyngeal swabs were collected as samples. Patients were suffering from high grade intermittent fever, cough, running nose, sore throat lethargy, drowsiness, sweating, headache. Samples were collected from Sharda Secondary School and Bright Future English School of Bulung V.D.C. Complications were seen in 4 patients among which three were suffered from pneumonia while one from bronchitis. The total infection in Bulung VDC were 600 in which only 200 of them visited OPD for health checkup.

Though the symptoms of all the infected patients was same so only five infected cases were taken. Samples were kept in plastic bags and separate bags were used for each patient's specimen with well labeling. Virus transport medium (VTM) is used to transport samples

and were transported at 4<sup>0</sup>C and processed within 24hrs in the laboratory (NPHL: Nepal Public Health Laboratory). The febrile patients was initially identified by either self-reporting or health checked done by public health assistants and doctors. Due to limited capacity to store and transport, first case definition was made of the infected people and samples were subjected to reverse transcription PCR (RT-PCR) for influenza sub-typing.

Just after the first outbreak on 2016/02/15 information was received from Gaurishankar Boarding School, Charikot, Dolakha. The immediate response team went there. 5 children of lower class were suspected to have suffered from influenza among which all were male and 6-9 years old. They were suffering from high grade intermittent fever, sweating, headache, cough, running nose, upper respiratory tract infections, lethargy and drowsiness. Source of originate of virus was unknown. Advised was given to close the school immediately to administration but they opened another day too. The virus was transmitted to 246 children of age group 5-15 out of total 330 students. Virus started from lower three class student to higher 8 class student. None of the adult were infected. Throat and nasopharyngeal swabs were taken as samples, transported as in abovementioned viral infection and confirmed through RT-PCR process.

### Management of outbreak

#### In first outbreak

First outbreak was seen in Bulung V.D.C in school children as well as local people. Transmission was continued in nearby VDCs too. Among the 600 infected cases, only 200 visited OPD centers so public awareness was made to overall VDC. Individuals with uncomplicated illness, self-management was recommended, including resting at home, increased fluid intake, analgesics, antipyretics and antihistaminic were given. They were provoked to maintain good nutrition and hygienic practice. The public awareness was made to use mask, not to shake hands with each other until this disease outbreak ends, not to use other handkerchief and towels to avoid exposures from nasal and mucus secretions, advice to drink boil water, and keep themselves away from crowed area. School health programs were conducted and advice to made the distance of 1m when have to talk with infected people. People were aware to inform immediately to district health office if such cases are found. Schools were closed for a week and advised not to open until the outbreak subside.

#### In second outbreak

Second outbreak was seen in Gaurishankar English Boarding School, Charikot, Dolakha in school children. Transmission was continued to their friends regularly but not to adults. Among 300 children, 246 were suffered from infection. Infected children were kept in isolation from other children 4 days because the transmission of disease was only in children to children. Individuals children with uncomplicated illness were aware as well

as their parents too. Among the infected children Self-management was recommended, including resting at home, increased fluid intake, analgesics, antipyretics and antihistaminic were given. They were provoked to maintain good nutrition and hygienic practice. The public awareness was made to use mask, not to shake hands with each other until this disease outbreak ends, not to use other handkerchief and towels to avoid exposures from nasal and mucus secretions, advice to drink boil water, and keep themselves away from crowded area. School health programs were conducted to nearby schools and advice to made the distance of 1m when have to talk with infected people. People were aware to inform immediately to district health office if such cases

are found. This school was closed for 4 days and advised not to open until the outbreak subside.

## RESULTS

The first outbreak was dangerous and transmission was to all the people of all age groups. The rate of transmission was very fast. For the investigation, throat and nasopharyngeal swabs were taken and dispatched in VTM at 4°C. All the patients were suffering from same symptoms, so only seven samples were taken and dispatched to NPHL to perform RT-PCR which showed following result.

**Table: 1 Outbreak I**

The infection was found to be due to influenza virus strain H<sub>3</sub>N<sub>2</sub> i.e. Hongkong flu..

Samples	Gender	ages	Sample collection	Samples	Results	Influenza vaccines
195	M	10	2016/02/12	Throat swab	H <sub>3</sub> N <sub>2</sub> +ve	Not given
196	M	18	2016/02/12	Throat swab	Negative	Not given
197	M	36	2016/02/12	Throat swab	H <sub>3</sub> N <sub>2</sub> +ve	Not given
198	Fe	9	2016/02/12	Nasopharyngeal swab	H <sub>3</sub> N <sub>2</sub> +ve	Not given
199	Fe	56	2016/02/12	Throat swab	Negative	Not given
200	Fe	63	2016/02/12	Throat swab	H <sub>3</sub> N <sub>2</sub> +ve	Not given
201	Fe	13	2016/02/12	Throat swab	H <sub>3</sub> N <sub>2</sub> +ve	Not given

**Table 2: Outbreak II.**

The infection was found to be due to influenza B virus.

Samples	Gender	ages	Sample Collection	Samples	Results	Influenza vaccines
295	M	8	2016/02/16	Throat swab	Influenza B +ve	Not given
296	M	12	2016/02/16	Throat swab	Negative	Not given
297	M	7	2016/02/16	Throat swab	Influenza B +ve	Not given
298	Fe	9	2016/02/16	Throat swab	Negative	Not given
299	Fe	10	2016/02/16	Throat swab	Influenza B +ve	Not given
300	Fe	11	2016/02/16	Throat swab	Influenza B +ve	Not given
301	Fe	13	2016/02/16	Throat swab	Influenza B +ve	Not given

## DISCUSSION

An outbreak of influenza A (H<sub>3</sub>N<sub>2</sub>) and influenza B has occurred in different places of Dolakha district, Nepal after the Great Earthquake of 2015. The present study provides the information about situation of influenza outbreak and the strategies made for the control of disease outbreak. The risk of an infectious disease outbreak after a natural disaster was increased because of various factors such as poor hygiene, overcrowding of emergency shelters, not availability of good and safe drinking water and people under struggling for survival. A variety of infectious diseases can be transmitted from person to person and place to place. The common source of infection is more likely to be a microbial agent circulating in the community rather than one introduced

from the outside. Among the natural disaster place the chances of outbreak of influenza virus is higher because animals with birds live together in temporary shelter. Influenza is a short lived seasonal epidemic respiratory viral infection causing significant morbidity and mortality.

The emergence of new and different influenza virus to infect people can cause and influenza pandemic. Based on two proteins on the surface of virus, influenza A is divided into two subtypes: the hemagglutinin (H) and neuraminidase (N). There are 18 different hemagglutinin subtypes (H<sub>1</sub> to H<sub>18</sub>) different neuraminidase subtypes (N<sub>1</sub> to N<sub>11</sub>).<sup>[13]</sup> Major changes in the envelope glycoproteins, hemagglutinin and neuraminidase is antigenic shifts whereas minor changes are called

antigenic drifts. Antigenic shifts are associated with epidemics and pandemics of influenza A, whereas antigenic drifts are associated with more localized outbreaks. Currently three types of influenza viruses affect people, which are called Type A, Type B and Type C<sup>[14]</sup> Among influenza A viruses (H1N1) and (H3N2) are predominant.<sup>[15]</sup> Wild birds are the primary natural reservoir for all subtypes of influenza A viruses and are thought to be the source of influenza A viruses in all other animals.<sup>[16,17]</sup> In present study the influenza outbreak of Type A was seen in February while immediately after one week influenza type B was seen but location was different. Similar type of study conducted by Central for Disease Control and Prevention (CDC) showed influenza activity in United States was increased in late December 2015 and was continued till March 2016.<sup>[18]</sup>

The outbreak of Influenza A (H<sub>3</sub>N<sub>2</sub>) has occurred in first outbreak. The chances of disease outbreak is high after natural disaster due to various factors such as poor hygiene, overcrowding of emergency shelters and contaminated drinking water.<sup>[19]</sup> Our study showed that the first outbreak was influenza A was subtype (H3N2) i.e. Honkong Flu which infected all kinds of age groups. Similar study conducted in Japan shows that influenza can cause outbreak in a disaster setting area where transmission are more likely occur in sharing rooms and space with familial links where outbreak virus was (H<sub>3</sub>N<sub>2</sub>).<sup>[20]</sup>

The consequent influenza outbreak occurred after one week of influenza A (H<sub>3</sub>N<sub>2</sub>) outbreak in children. Children were on temporary learning centre (TLC) because of ramshackle building structure due to devastating earthquake. First, the sign was seen in small class children and transmitted to upper class within 3 days. All children were suffered in which coughing, high grade fever, sore throat, nasal obstruction, chills were common symptoms. The similar symptoms was seen in the study conducted by World Health Organization in Switzerland.<sup>[21]</sup> RT-PCR was done through which it was ensured that the outbreak among children was influenza B. Among the seven tested samples, four were positive. Similar study was also carried out in India in which RT-PCR was used for the diagnosis of influenza B virus.<sup>[22]</sup> After the outbreak schools was closed for 4 days. The symptoms was only seen in children and adults were not suffered which indicates that adults were already confronted with the virus and got immunity against it. During outbreak many people use antibiotics randomly without consulting clinicians and without proper sensitivity test may cause antibiotic resistance though antibiotics are not used to treat viral diseases.<sup>[23, 24, 25]</sup>

Hence in both outbreak cases awareness of self-management, home rest, increased fluid intake, analgesics, antipyretics and antihistaminic, maintain good nutrition, good hygienic practice, use of mask, not

to shake hands with each other until this disease outbreak ends, not to use other handkerchief and towels to avoid exposures from nasal and mucus secretions, advice to drink boil water, and keep themselves away from crowded area was suggested which was effective in control of both outbreak. When school was closed it subsided sharply so that was controlled easily.

## CONCLUSION

Influenza can cause outbreak during epidemic influenza season. The transmission route is direct contact or aerosols contact. Home rest, fluid intake, good nutrition, good hygienic practice, use of mask, prevention of direct contact with patients and the patients used goods can help in controlling influenza.

## REFERENCE

1. Shrestha S. Langtang is gone. Nepali times. 1 May 2015. Retrived 2 may 2015.
2. Kaini S 29 April, 2015. Great earthquake wipes out Barpak. The kathmandu post. Retrived 2 may 2015.
3. McCarthy J 30 April 2015. "He carried his mom on his back for 5 hours En route to medical care" Montana public radio. Retrived., 2 May 2015.
4. Earth quake hit Nepal at high risk of landslides in coming weeks. Free press journal., April 29, 2015.
5. Nepal Earthquake Assessment Unit. District profile: Dolakha., 19 August 2015.
6. Dolakha goes on high alert for flu outbreak. The Himalayan times. September 18, 2015, Nepal
7. Mimura S, Kamigaki T, Oshitani H. Infectious disease risk after great East Japan earthquake. J Dis Res., 2012; 7(6): 741-745.
8. Kouadio IK, Aljunid S, Kamigaki T, Hammad K, Oshitani H. Infectious disease following natural disasters: prevention and control measures. Expert Rev Anti Infect Ther., 2012; 10(1): 95-104.
9. Gu Y, Shimada T, Yasui Y, Tada Y, Kaku M, Okabe N: National surveillance of influenza-associated encephalopathy in Japan over six years, before and during the 2009–2010 influenza pandemic. PLoS One., 2013, 8(1): e54786.
10. Kamps BS, Hoffmann C, Preiser W. Influenza report on Virology of Human Influenza, 2006. Available at [www.influenzareport.com/ir/virol.htm](http://www.influenzareport.com/ir/virol.htm). Accessed 17th March 2013.
11. Fujimoto S, Kobayashi M, Uemura O, et al. PCR on cerebrospinal fluid to show influenza-associated acute encephalopathy or encephalitis. Lancet., 1998; 352: 873–5.
12. Wu P, Goldstein E, Ho LM, Yang L, Nishiura H, Wu JT, Ip DK, Chuang SK, Tsang T, Cowling BJ: Excess mortality associated with influenza A and B virus in Hong Kong, 1998–2009. J Infect Dis., 2012; 206(12): 1862–1871.
13. Influenza Type A viruses and Subtypes "Centers for disease control and prevention. 2 April 2013.
14. Types of influenza viruses" Centers for disease control and prevention. 19 August, 2014.

15. Longo Dan L, Harrison TR. Harrison's principles of internal medicine. 18th edition ISBN McGraw-Hill, 2012, 9780071748896.
16. Webster RG, Bean WJ, Gorman OT, Chambers TM, Kawaoka Y: Evolution and ecology of influenza A viruses. *Microbiol Rev.*, 1992; 56: 152–179.
17. What you should know for the 2015-2016 influenza season. Centers for disease control and prevention. 4 May, 2016.
18. Watson JT, Gayer M, Connolly MA: Epidemics after natural disasters. *Emerg Infect Dis.*, 2007; 13(1): 1–5.
19. Kamigaki T, Seino J, Soma NN, Otani K, Oshitani H. Investigation of an influenza A (H3N2) outbreak in evacuation centres following the great east Japan earthquake, 2011; 14(34): 1-6.
20. World Health Organization. 2011. Influenza update—26 August 2011. World Health Organization, Geneva, Switzerland.
21. Anukumar B. Rash associated with influenza B virus infection. *Natl Med J India.*, 2013; 26: 186.
22. Subedi S, Chaudhary M and Shrestha B. High MDR and ESBL producing *Escherichia coli* and *Klebsiella pneumoniae* from urine, pus and sputum samples. *British Journal of Medicine and Medical research.*, 2016; 13(10): 1-10.
23. Antibiotics are not the answer "Centers for disease control and prevention. November 16, 2015
24. Subedi S, Maharjan J and Shrestha B. Antibiotic susceptibility test of *Klebsiella pneumoniae* and *K. oxytoca* isolated from different clinical samples and perform random amplified polymorphic DNA among *K. pneumoniae*. *British Microbiology Research Journal.*, 2016; 12(6): 1-11.