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**Swine Flu: A Preliminary Study of the Planning and Policy of Nepal to
Combat the H1N1 Pandemic**

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ABSTRACT *The research was conducted to analyze the activities implemented by the Government of Nepal to deal with the 2009 H1N1 pandemic. The basis of the analysis was the National Avian Influenza Pandemic Preparedness and Response Plan (NAIPPRP). This plan was compared to World Health Organization (WHO) recommendations and the United States preparation plans. The H1N1 situation in Nepal, between 2009 April to 2010 March, was analyzed considering the country's profile on the basis of data available online and document provided by WHO-Nepal. The first reported outbreak of H1N1 occurred in Mexico in early April 2009 and soon spread to the United States (US), and then globally. In the US, the outbreak occurred primarily in the border-states. The Government immediately took necessary steps to mitigate the effect in all the states preparing the country for the next pandemic wave. However, Nepal with capacity constraint, few financial resources, low manpower and limited technology, political instability has undergone challenges to implement a plan. Issues such as an under-developed health care system, the topography of the country, economic remoteness, difficulties in enhancing literacy among the female and rural populations, conservative social custom and traditions and lack of central planning and administration has contributed to the implementation problems. The Avian Influenza Control Project (AICP) has made an endeavored to improve and implement mitigation measures to deal with the H1N1. However due to existing challenges; country's associated constraints and uncertainty in the development of the health care system, the capability and effectiveness of the diagnostic laboratory, National Public Health Laboratory (NPHL) and the surveillance measures implemented, issues following the mitigation measures applied remains. Transparency to gain public confidence and assure the citizens of their safety and capability enhancement in the health sector is necessary.*

Keywords: *H1N1 influenza; NAIPPRP; WHO; AICP*

INTRODUCTION

Influenza usually causes an acute self-limiting upper respiratory tract infection, with regular levels, usually peaking between December and March in the Northern Hemisphere, and during June to September in the Southern Hemisphere. The causative agent of influenza, “the influenza A virus”, through continuous point mutation of its gene can possibly generate the reassortant virus, a phenomenon called as antigenic shift bringing about the potential pandemic. H1N1 2009 virus is a consequence of antigenic shift, a triple reassortant virus, developed as a result of reassortment among swine, avian and human influenza strain, pigs acting as the intermediate host or mixing vessels for gene reassortment among strains.

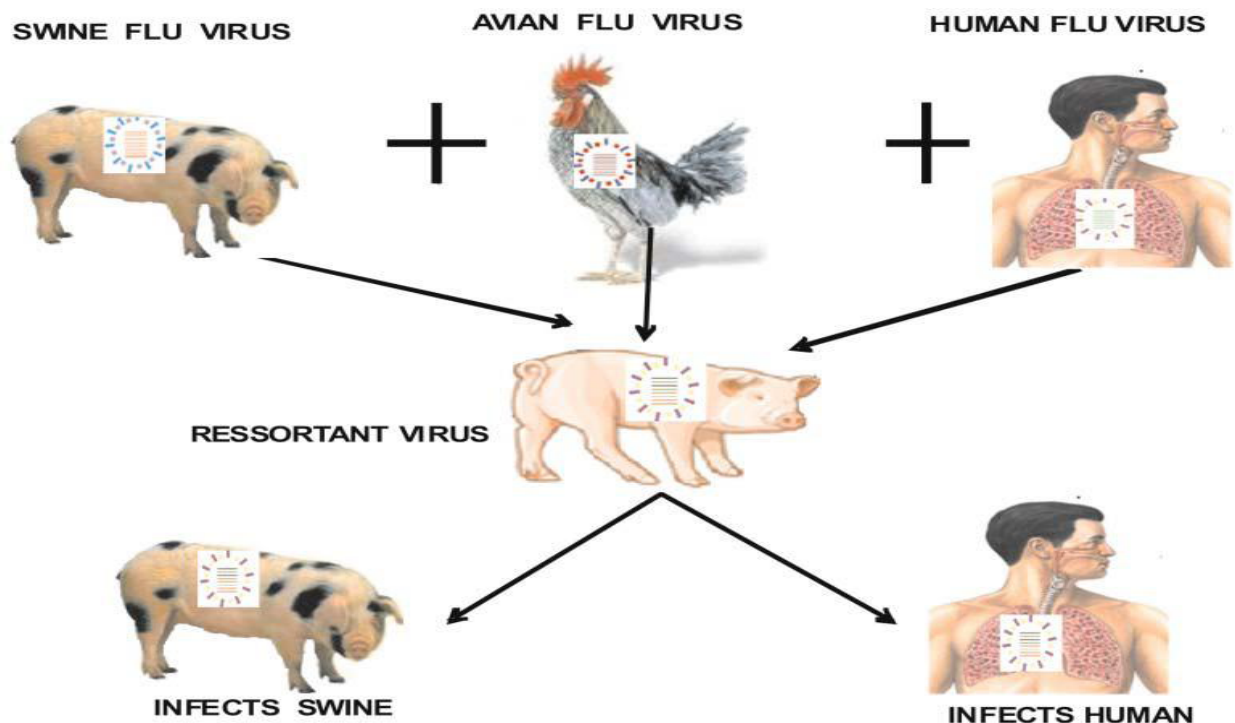


Figure: Genetic reassortment in influenza virus developing H1N1 subtype.

The transmission of swine flu can occur by inhalation of infectious air borne droplets or droplet nuclei through direct or indirect contact. Transmissions of the virus subtype to human and then from human to human, pandemic results. The clinical manifestation of swine flu appears after an

incubation period of 1-7 days. The symptom includes fever, cough, sore throat, runny or stuffy nose, myalgia, body aches, headache, chills and fatigue with occasional gastrointestinal upset. Apart from these symptoms, individual might show complication as pneumonia, respiratory failure and can get mixed infection with bacteria. The infection can further exacerbate with rhabdomyolysis on renal failure, myocarditis on worsening of underlying condition as asthma and cardiovascular disease. The other unusual symptoms reported are conjunctivitis, parotitis, hemophagocytic syndrome. Individuals that are at high risk of developing severe disease falls among the group of younger less than five years, elderly people with suppressed immunity and pregnant women with chronic systemic illnesses, adolescents on aspirin and immune-compromised patients with lower respiratory tract infection. Diagnosis of H1N1 2009 pandemic virus is based upon three tests; PCR/RT-PCR, viral culture and 4-fold rise in virus-specific neutralizing antibodies. Control and prevention consist of isolation (social distancing), good infection control practices (standard droplet and contact precaution, practicing respiratory and hygiene etiquette), supportive care and use of antiviral drugs as oseltamivir, zanamivir and peramivir, and immunization.

To predict the proper measures to be taken in harmonizing the global health with the emergence of the new influenza virus subtype capable of uncertain pandemic threat, the World Health Organization (WHO), has developed guidelines regarding the preparedness and preventive measures. WHO has identified different phases of pandemic with the aim to determine the level of prompt response and appropriate measures. WHO requires every country to formulate national pandemic and response plans plus implementing the measures effectively with regular monitoring.

NEPAL, AN OVERVIEW

Nepal is a small developing country (147,181 sq km) with only 17% of total population (28,563,377 est. 2009) contributing to urbanization. Nepal, located in the Southeast Asia with porous Indo-Nepal border and limited control over the Chinese border, allows the flow of thousands of livestock and people in and out of the country every day, contributing the easy passage of diseases. A landlocked country with predominance of rugged mountainous areas have greatly diminished the development of transportation and communication, making large areas of the country poorly accessible with limited health care facilities and communication on the areas. Nepal, a land of diversity with multi-ethnic, multi-lingual and multi-cultural behavior, shows clear demarcation and discrimination among castes and gender. The literacy rate is 48.6%, with male contributing 62.7% and female 34.9%. There is a low health profile with high mortality and morbidity rates, especially among women and children from acute preventable childhood diseases, complications of child birth, nutritional disorders and endemic diseases such as malaria, tuberculosis, leprosy, STDs, rabies, vector borne diseases. With economic development severely constrained by geographic, topological and socio-cultural factors, one third of Nepal's population lives below a poverty line. In Nepal, pig husbandry and pork production is at an early stage of development and are widely distributed in all eco-regions and developmental regions, with an estimated total population of 935,075. Pig farming is accepted socially and culturally by certain ethnic groups only such as Rai, Limbu, Magar, Kami, Damai. Pig farming is associated mainly with very poor, mostly landless, small farmers and low social groups, contributing to the ignorance of these animals in improvement programmes. Farmers are practicing traditional pig farming in a scavenging system, with ignorance in health and hygiene practices.

H1N1 2009 PANDEMIC

In the early April 2009, the first human influenza outbreak occurred in Mexico, which then spread to United States. On June 11, 2009, with the global contagious spread of the novel influenza virus (H1N1) from person to person and from country to country, at least 74 countries reported approximately 30,000 confirmed laboratory cases. WHO raised the pandemic alert level to pandemic phase 6, indicating moderate severity, guiding the nations worldwide to implement their national action plans and mitigation measures to contain the spread of H1N1 pandemic. Up until 11 June 2009, US reported 13,217 laboratory confirmed cases with 27 deaths, India 9 cases, China 174 cases and Nepal no cases of H1N1. According to WHO, as of 27 November 2009, more than 207 countries reported laboratory confirmed cases of pandemic influenza H1N1 with a death count of more than 7,820 and heightened disease activity in US and high ILI (Influenza like illness) cases in India, Nepal. However, the actual number of cases most likely was much higher as laboratory facilities for the confirmation of diagnosis is limited. With the arrival of year 2010, as of 28 February, worldwide more than 213 countries reported laboratory confirmed cases with at least 16,455 deaths. By the time, most areas indicated declining disease activity, US indicated low prevalence of influenza virus yielding overall low and declining pattern of pandemic influenza activity, however, active transmission were observed in of Southeast Asia. According to WHO, as of 10 March 2010, Southeast Asia was showing active transmission of the infection. According to WHO/SEARO, Nepal has reported cumulative cases of 172 with 2 deaths as of 2 February 2010. No cases of H1N1 have been reported since that date. In the mean time the candidate vaccine virus (CVV) has been developed, H1N1 vaccine now has been manufactured, antiviral susceptible to the subtype been identified. WHO is making an effort to distribute the donated H1N1 vaccines, antiviral and PPE to the countries in need of vaccine.

INFLUENZA PANDEMIC PLANS AND POLICIES

Hong Kong 1997, the first outbreak of influenza A from subtype H5N1, designated as the Highly Pathogenic Avian Influenza (HPAI) was identified which spread throughout the world at an alarming rate from East Asia to Central Asia. By 2003, it spread to Middle East, Europe, Africa, and South Asia, infecting millions of domestic poultry causing severe human disease and escalating number of human infections. WHO in April 2005, activated the pandemic alert phase 3 and raised concerns about the possibility of the evolution of the next influenza pandemic with extreme severity and disastrous consequences.

United States- Pandemic plans and policies:

With the emerging incidence of Avian Influenza in Asia, the Homeland Security Council (HSC) of United States in November 1, 2005 released “*the National Strategy for Pandemic Influenza*”, an approach to address the threat of pandemic influenza resulting from either of the avian influenza or another influenza virus. The strategy provides a framework for the future planning activities and efforts to deal with the influenza pandemic that can occur with varying severity and with varying strain types focusing on a whole of nation approach.

In November 2, 2005, U.S. Department of Health and Human Services, released the “*HHS Pandemic Influenza Plan*”, with a goal to achieve a state of readiness and quick response, providing guidance to national, state and local policy makers and health departments, outlining the preparation and response planning together with the roles and expectation of the responsibilities plus the specific needs and opportunities to build robust preparedness for and response to pandemic influenza.

In May 2006, the HSC released the “*National Strategy for Pandemic Influenza Implementation Plan*” addressing more than 300 critical actions needed to deal with pandemic threat, further clarifying the roles and responsibilities of governmental and non-governmental entities, including Federal, State, local, and tribal authorities and regional, national, and international stakeholders together with preparedness guidance for all segments of society.

Nepal- Pandemic Plans and Policies:

With the report of H5N1 infection in neighboring countries and the existing remoteness on borders and insufficient check post, lacking financial resources, manpower and other limitations is at potential risk of spreading the infection.

To deal with the pandemic consequences, the Ministry of Health and Population (MoHP), the key acting body on the health field responsible for improving the overall health of the general public, together with Ministry of Agriculture and Cooperatives (MoAC) in 2005 prepared the “National Avian Influenza and Influenza Pandemic Preparedness and Response Plan” (NAIIPPRP) with technical assistance from the World Health Organization (WHO) and the Food and Agriculture Organization (FAO). The main objective of NAIIPPRP was to “prepare the country for early recognition and containment of a possible outbreak of avian influenza (AI) in the country, acting to reduce the risk of human infection in the presence of animal disease and identifying and promptly treating human influenza cases where they occur. In the event of human to human transmission of H5N1 or other novel virus and a possible influenza pandemic affecting Nepal, the plan aims at building preparedness to contain it rapidly and mitigate its health and socio-economic impacts”. The NAIIPPRP has provided a strong basis on which to

detect and combat possible outbreaks. The plan has also outlined the institutional mechanisms for carrying out those activities being candid about the capacity and resources constraints. The plan provides a strategic framework for combating the influenza pandemic considering the five main pillars as recommended by WHO: planning and coordination; surveillance and laboratory strengthening; prevention and containment; health systems response and communication. For the proper implementation of the strategic plan, the Nepal government developed the operational plan detailing various actions and improvement which need to be accomplished in the health care system, together with a complete analysis of the budgeting under two main components, the Animal Health component and the Human Health component.

Animal Health components:

- a. Surveillance and Epidemiological Investigation
- b. Strengthening Animal Quarantine Services
- c. Strengthening Capacity of the Veterinary Laboratory Network
- d. Control and Containment of HPAI and Strengthening Field Veterinary Services
- e. Public Awareness Information and Communication
- f. Compensation and Rehabilitation
- g. Project Management Unit, monitoring and evaluation and Technical Assistance

Human Health components:

- a. Surveillance and Laboratory Strengthening
- b. Prevention and Containment
- c. Health Care Delivery System Preparedness and Response
- d. Public Awareness Information and Communication
- e. Project Management Monitoring and Evaluation

Some of the capacity constraint identified in the strategic and operational plan involves;

a. Most of Nepal's villages are unreachable through road transport, the only transport being the costly air travel. Surveillance and epidemiological investigation is utmost impossible on those areas.

b. Strengthening over the border control is of prime necessity.

c. To enhance effective surveillance and epidemiological investigation in the livestock, capacity building of the veterinary, wild life professional and village animal health workers is required together with improvement in animal quarantine. Though Nepal has 8 animal disease diagnostic laboratories, none of them are dedicated to HPAI. There is a lack of skilled man power, equipment and capital financial constraint.

d. The National Public Health laboratory (NPHL) is limited to performing rapid test to distinguish influenza A and B only.

e. Nepal has a diverse media environment consisting of broadcasters, numerous radio stations and television channels and press with dozens of daily newspapers and hundreds of weeklies. About 64% of Nepal's urban population and 50% of rural population has regular access to radio. Television access is far lower with 20% in urban and about 1% in rural areas. Though there exist numerous publications, the low literacy rate among the population indicates low viability of press among the population. In addition, poor knowledge among the general public, journalist and reporters about the AI is creating distrust and misunderstanding in the communities.

With low economic condition and resources, to ensure the ample protection of the people of Nepal and its livestock, the Government of Nepal, with the operational plan in place, requested for the World Bank assistance. The request was approved in 19 January 2007 with a total grant of \$18.2 million. A four year project plan, "Avian Influenza Control project (AICP) – Nepal,

2007/08-2010/11”, was approved and is ongoing with a completion date of 31 July 2011. The goal of AICP is to reduce the risk of human avian influenza infection in the presence of animal disease, to be able to identify and treat promptly humans infected with avian influenza, and to build preparedness to contain rapidly and mitigate the health and socio-economic impact of an influenza pandemic affecting Nepal. With the completion of the four year AICP, it is hoped the health care system of Nepal will be enhanced so as to prevent, detect and contain an avian influenza outbreak.

Under the animal health component, the project will enhance AI prevention and preparedness programs through strengthening the veterinary services, disease surveillance and diagnostic capacity. The project will be focused on strengthening the laboratory capacity of one of the eight animal disease diagnostic laboratories to BSL (Bio-safety level) 3 and the remaining seven to BSL 2. The project will focus on controlling and containing the outbreak as well as providing compensation fund to assist the poultry owners for their loss.

Under the human health component, the project aims to prevent the human influenza caused by HPAI through enhanced year round surveillance by strengthening the existing disease surveillance capacity at the national, regional and district level. This will be accomplished by building and implementing an influenza surveillance system on the existing surveillance system and building the capacity to detect the occurrence of human cases of avian influenza. Additionally, it calls for providing and ensuring a laboratory network support at the health care facilities to assist in implementation of the national influenza surveillance system. This focuses on improving the laboratory capacity to enable accurate and effective diagnosis and case detection with conventional and real-time Polymerase chain reaction (RT-PCR) and enzyme linked immunosorbent assay (ELISA), developing virus isolation capabilities (typing, subtyping

and strain identification capacities). There is a need to enhance BSL 3 capacity at NPHL, development of laboratory information management system and appropriate trainings of personnel.

Under the prevention and containment measures, the project aims to prevent avian and seasonal influenza transmission in high risk occupational settings. This attempts to accomplish in developing a modern human quarantine system in main points of international transit and building the capacity for pharmacological and non-pharmacological interventions as antivirals. PPE (Personal Protection Equipment) and vaccination will need to be provided to the public plus information about social distancing and monitoring the occurrence of infection during different pandemic phases. This requires planning for the acquisition and use of pandemic vaccines and developing a legal and regular framework for public health interventions during epidemics.

Under the health care system delivery and preparedness response, the project aims on developing and implementing a system of acute respiratory disease triage and referral. Capacity building of the primary health care system (district and below) together with the preparation and implementation of contingency plans is necessary to meet the health care needs during an influenza pandemic.

The project also aims on enhancing the communication strategy to ensure accurate information being relayed to the general public through the resources available

SCENARIO: H1N1 PANDEMIC

US scenario:

HHS has made significant progress in building international and national monitoring and disease surveillance capacity contributing stronger worldwide disease surveillance networks, improved

laboratory capacity for analyzing virus samples and better trained workforce personnel. According to the implementation plan three year summary by the year 2009, of the 324 critical actions identified in the National Strategy, Implementation Plan, 244 actions have been accomplished.

With the emergence of H1N1 outbreak in the border country Mexico, all the States of US with the pandemic plans in hand took a quick action for pandemic influenza preparedness and response. On 26 April, with prompt identification of the H1N1 cases, HHS issued a nationwide public health emergency declaration with confirmed 20 cases. CDC developed and updated the guidance document, developed and distributed to all its States, the diagnostic test kit to detect novel H1N1 virus, developed the candid vaccine and new antiviral, initiated immunization campaign. The United States with the global pandemic worldwide is helping improve access to vaccines and antiviral drugs for developing countries. The United States has provided significant support to the World Health Organization's vaccine programs. The numbers of systemic gaps in the nation's ability to respond to a pandemic flu outbreak were identified in response to the early lesson learned from H1N1.

CDC between April 2009 to January 2010, had estimated the total H1N1 cases to be between 41 million to 81 million and the estimated death within 8,330 to 17,160. According to CDC, there has been a gradual decline in the cases of H1N1 and the influenza activity in the year 2010, which can be contributed to the timely development and manufacturing of the CVV and the vaccines and effective implementation of the immunization program among the priority groups. Proper education programs, availability of advanced laboratory and diagnostic equipment with trained man power and well advance health care system together with the identification of the

effective antiviral, effective surveillance and containment measures were of great value in stemming the pandemic in the US

Nepal scenario:

To contain or mitigate the effect of H1N1 influenza pandemic, the Government of Nepal has considered the “National Avian Influenza and Influenza Pandemic Preparedness and Response Plan”, the strategic plan developed for AICP. Nepal government, with the progress on ongoing AICP, on overcoming the constraint associated with the health care system is modifying the NAIIPPRP. According to WHO-SEARO, Nepal has developed the first draft of the revised NAIIPPRP under the heading “Avian Influenza Pandemic Preparedness and Response Plan for Government of Nepal, (AIPPRP)”.

According to the MoHP, immediately following WHO pandemic alert 5 on 29 April 2009, the government initiated surveillance of incoming travelers on the main port of entry, the international airport and on the borders. A health desk was established at the airport and screening done through a series of questionnaire and temperature measurement. On 28 June 2009, the government confirmed 3 cases of H1N1, screening at the Tribhuvan International Airport on passengers returning to Nepal after a recent stay in Washington D.C. DoHS on 16 October 2009 discontinued the surveillance health desk at the international airport pointing to its ineffectiveness on the current scenario of reports of several cases in various parts of the country confirming an outbreak of H1N1. The MoHP in 6 November 2009, confirmed 60 cases of H1N1 with no deaths based on a report submitted by the National Public Health laboratory (NPHL) on analysis of the nasal swab. Full recovery was reported with all individuals with Tamiflu, indicating mild controlled outbreak. According to WHO-SEARO, Nepal government in coordination with WHO, is scheduled to receive vaccine in the first quarter of 2010.

According to the United Nation bulletin on influenza pandemic update as of 24 august 2009, to mitigate the effects of H1N1, the Government of Nepal initiated the following activities:

- a. Initiated surveillance activity and health screening at Tribhuvan International Airport and major land crossing (India and China border).
- b. Developed and circulated guidelines on who should get laboratory test; who should seek immediate medical care; and who should get antiviral.
- c. Public and private hospitals including security forces' hospitals have been instructed to establish an isolation room.
- d. Standard Operating Procedures on patient management have been circulated widely to all hospitals.
- e. The community mitigation and health promotion materials have been disseminated to the community.
- f. Media messages on H1N1 and preventive measures have been disseminated.

Benefits of AICP on H1N1 pandemic as reported by MoHP, 16 August 2009:

MoHP and the WHO-Nepal, issued a joint press release highlighting the activities taken by the MoHP pointing the alert status of the nation benefitting from ongoing AICP plan to control the current January and February AI pandemic in Morang and Jhapa districts.

- a. Experts of various specialties are already recruited at the central and regional levels,
- b. Surveillance system has been established for influenza like illnesses,
- c. Various trainings/orientation have been provided to
 1. District, Regional and Central rapid response team (RRT) on surveillance and response (320 health workers of different districts)

2. Medical doctors, physicians, pediatricians, nurses, other health workers on case management and infection control (81 from different 20 hospitals)
 3. Risk communication to health workers and journalists (37)
 4. On pandemic preparedness plan to all health workers (222 to various districts)
 5. On laboratory procedures on collection, transportation and testing to laboratory staff (all lab technicians of districts)
 6. To district and regional stakeholders
- d. Laboratory capacity of National Public Health Laboratory has been strengthened.
 - e. Strengthening of the hospital capacity on case management and infection control.
 - f. Establishment of Referral Hospitals.
 - g. Equipments have been delivered to various hospitals
 - h. Pandemic Preparedness Plan is in place.
 - i. Stockpiling of Tamiflu, PPEs, Masks, sanitizers and others.

According to the press release, with the benefit of ongoing AICP on hand, MoHP is better prepared for the H1N1 2009 pandemic and took the following activities very rapidly and efficiently with technical, logistical and financial support from WHO.

Actions taken by MoHP after the emergence of H1N1 virus:

- a. Immediately after WHO alerted MoHP on H1N1 and with close collaboration between MoHP and WHO, the series of planning and coordination meeting were conducted with various line ministries, departments and other stakeholders.
- b. All district health offices and regional health directorates were alerted on influenza like illnesses surveillance.

- c. Airport health screening desk was established on 29th April, 2009 (Total passengers screened 185,335 and total flights screened 2000)
- d. Trainings events were conducted on surveillance, case management, infection control and community mitigation to health workers and other relevant people at central, regional and district levels.
- e. Laboratory capacity was strengthened to carry out the testing of H1N1 in NPHL.
- f. International and National trainings have been provided to Laboratory person to conduct testing of H1N1.
- g. Stockpiling of Tamiflu (38,000 treatment regimen), masks, sanitizers and others have been done.
- h. Hospitals were further strengthened on isolation and MoHP has sent circular to all public and private hospitals to immediately allocate the ward/unit for isolation. A guideline for establishing isolation ward has been circulated.
- i. With the H2P partners community level pandemic preparedness plan has been developed. Trainings events are being conducted in various districts
- j. Risk communication message have been given to the public through various media and other sources. Risk communication templates and leaflets (Flu Dos and Don'ts) have been distributed to all districts. Community volunteers are using these leaflets to communicate with the public.
- k. Control Room is established at Epidemiology and Disease Control Division (EDCD).
- l. MoHP and WHO is providing additional equipments to 5 hospitals for critical care of the patient

ANALYSIS: CONTROVERSIAL SCENARIO OF H1N1 PANDEMIC IN NEPAL

H1N1 infection: A highly contagious air borne infection from H1N1 subtype of Influenza A virus, the triple reassortant virus, spreading easily through air borne droplets, effecting mainly young and adults, immune-compromised individual, pregnant woman.

No cases as of 11 June 2009:

Nepal with limited control over the borders, sheltering the refugees in various areas of the country, with the incidence of H1N1 infection in neighboring countries, reported no cases of H1N1 as of 11 June 2009, the date of declaration of pandemic phase 6 by WHO.

The country with the associated capacity constraint and lack of transparency regarding the improvement in the health care system with low health profile and nutritional status, poor sanitary condition and hygiene etiquette, is highly prone to contagious airborne infection. H1N1 influenza, being a contagious airborne disease, no borders or boundaries can prevent its spread. If we consider no cases as reported by the Government of Nepal, this is good news for the Nepalese. So, does this indicate a better health profile and advanced health care system in Nepal? However, on considering the facts of Nepal and the characteristics of H1N1 infection, the report may not seem to convey accurate information.

Anticipated contributing factors

- There is a lack of proper diagnostic test.
- The implementation of ineffective surveillance and screening procedure throughout the country.
- Poor communication strategy and poor health care system with limited trained health and non-health sector personnel.

- Nepalese may be naturally immunized to the subtype, however according to WHO-Nepal, this requires further research to conclude.

Surveillance activity and effectiveness:

Following the WHO declaration, surveillance health desk was immediately established at the Tribhuvan International Airport which resulted in the identification of the first three cases on 28 June 2009 on the basis of report submitted by NPHL. Later, with the confirmed outbreak of H1N1 within the country at various locations by MoHP as of 15 October 2009, the surveillance health desk was cancelled. No cases have yet been identified from the border side.

The identification of cases from the passenger screened in the airport, after nearly a week of their arrival, indicates some degree of effectiveness of the screening health desk at the international airport. The screening done on the borders still remain under question indicating ineffective and inadequate surveillance with no cases among the massive mobility population entering and exiting the country at these levels. The government of Nepal has not made public information about the surveillance being done on pig farming regarding H1N1 and probable cases.

Anticipated contributing factors

- Less establishment of screening post with low mobilization of HCWs in the area.
- Lack or insufficient training to the HCWs on the pandemic.
- Lack in monitoring of the possible cases of ILI.
- Lack of specimen referral system in the area.
- Lack of diagnostic tool in identifying the infection.
- No prior-evaluation and reviewing of surveillance method applied.
- Difficulty in disseminating information about PI to general public as well the HCWs.
- Lack of improvement programs in pig farming plus the surveillance system.

Diagnostic capability of Nepal:

According to WHO report published on 13 May 2009, listing of the countries able to perform PCR to diagnose influenza A (H1N1) virus infections in human, Nepal does not fall under the category. According to the report of the WHO/SEARO, partners meeting on H1N1 2009 at New Delhi on 21 August 2009, Nepal does not have Influenza center lab (ICL) capable of virus isolation, Polymerase chain reaction (PCR).

However, there exist a NPHL, the central lab, the strengthening of the laboratory capacity of NPHL, is one of the main aspects of AICP, which will help in diagnosing and managing the disease. The AICP focuses on three staged development of the NPHL. The first phase is distribution and use of rapid antigen detection kits, the second phase involves use of polymerase chain reaction (PCR) methods, and the third involves virus isolation and tissue culture, the development of bio-safety level three (BSL) facilities.

According to AICP, strategic and operational plan 2006, the central laboratory, NPHL has basic laboratory equipment, much of which is substandard, outdated, and unreliable. NPHL is limited to performing rapid tests distinguishing influenza A and B virus only, with the drawback of the recognized low sensitivity of these tests. Though the laboratory is equipped with PCR equipment and can perform conventional PCR for other organisms. It is in need of reagents, chemicals, and accessories to do conventional PCR for influenza. To perform the more reliable and sensitive test of detection, the real-time PCR (RT-PCR), NPHL will require facilities renovations necessary to do PCR testing and the training needs together with need of equipments, primers, reagents, supplies, and accessories and laboratory management information system, and computer equipment to run and interpret PCR. However, BSL-3 is a long term goal and requires facility

renovations, equipment, and supplies necessary for BSL-3, training to operate such a facility, and personnel requirements.

WHO has guided the nation to report confirmed cases as per three confirmatory tests result; PCR, viral culture and serology test, 4 fold rise in pandemic (H1N1) 2009 virus virus-specific neutralizing antibodies. WHO has guided countries without a designated National Influenza Center (NIC), with no ongoing influenza surveillance activities or with no laboratory capacity to diagnose the pandemic (H1N1) 2009 influenza virus to collect representative samples from clinically compatible cases from newly affected areas and among severe cases per week and send to neighboring countries or regional influenza laboratories with laboratory capacity for virus characterization.

The laboratory confirmation report of H1N1 cases from NPHL requires transparency, so as to assure the public regarding the improvement on the diagnostic capabilities of NPHL and the type of test being implemented or collaboration with certain national private or international organization for confirmation. The government of Nepal, in order to assure improved health care system requires having some degree of transparency to gain public confidence.

Anticipated contributing factors

- The Government of Nepal is either collaborating with national private or international laboratory for confirmation however, the government has not made public about the collaboration being adopted.
- The diagnosis is either being done on the basis of rapid antigen test and clinical symptoms.
- With the ongoing AICP, the diagnostic capacity of NPHL might have been enhanced.

Immunization program:

The government of Nepal has not initiated any vaccination program as it is still awaiting vaccine deployment from WHO. By now the country should have been ready for the next pandemic wave with effective immunization program and stockpiling in hand of antiviral and appropriate personal protection equipment.

Anticipated contributing factors

- There exist lack of leadership and management within MoHP.
- The ongoing political instability is contributing to lack of decision making.

Total H1N1 cases identified:

According to WHO/SEARO, Nepal has reported cumulative cases of 172 with 2 deaths as of 2 February 2010. No cases of H1N1 have been reported since that date when WHO is reporting increasing incidence of H1N1 in Southeast Asia. The cases cannot be taken as the actual cases when the surveillance measures and diagnostic tools applied are in question for the effectiveness.

Anticipated contributing factors

- There is an ineffective evaluation of surveillance program particularly in the remote places deprived of communication and transportation.
- The diagnostic tools are not effective and are not readily available in areas most likely to have incidence of outbreak.
- NPHL lab diagnostic capacity appears to be lagging.

Efficacy of the mitigation measures applied apart from AI incidence place:

With the pandemic preparedness on hand from AICP and existing plans and programs implemented to deal with the January and February 2009 AI pandemic in Jhapa and Morang district, the government of Nepal initiated the mitigation measures. The national action

preparedness plan and the mitigation measures applied seems to correlate with each other as per the activities been addressed by the MoHP.

However, the efficacy of the measures applied remains in question regarding other areas of Nepal where no sign of AI have been observed.

Anticipated contributing factors

- The Effectiveness of surveillance and its coverage in other parts of the country may be limited.
- Selection of samples and diagnostic capability of NPHL remains in question.
- Alerting and dissemination of information to the general public, particularly in the remote areas is difficult.
- Up-to-date trainings to health and non-health sectors in rural areas.

CONCLUSION

The H1N1 infection capable of spreading in a short period of time affecting children and adults below the age of 65, the less vulnerable population, has become the matter of global health concern. With the pandemic of the H1N1 infection, both United States and Nepal implemented their preparedness plans to mitigate the effect of pandemic.

United States, being a highly developed country with advanced technology and well managed health care system and high health profile is handling the pandemic effectively, with the country ready for next pandemic. Until the current date of H1N1 2009 pandemic from the release of HHS plan in the late 2005, the US has made tremendous progress in the field of health care system with sufficient stockpiling of antiviral and PPE. The US has undergone improvement in the field of development of vaccine and new antivirals. The US has effectively raised awareness among

all the level of government as well as the general public on their roles and responsibilities during a pandemic with each state ready to respond with the pandemic plan in hand that had been well evaluated and exercised.

US with effective surveillance, containment and mitigation strategy immediately identified the cases. With advancement in the healthcare system, US developed the diagnostic tools, initiated vaccine production and identified the susceptible antiviral, peramivir. Nationwide campaign on immunization initiated making the nation ready for next pandemic wave.

However, Nepal with its ongoing AICP, a World Bank funded project to strengthen the health care system of the country is better prepared for the AI pandemic and initiated its mitigation activities as per the existing AI pandemic plan. According to the MoHP, with the pandemic in the health field of Nepal, all the mitigating measures as per the national plan have been implemented to deal with the H1N1 pandemic and seem to be appropriate given the extent of the influenza pandemic identified.

However, to obtain the actual picture of the H1N1 2009 pandemic in Nepal, one must take in consideration the capacity constraint associated with the country. The mitigation measures need to be further evaluated and reviewed. Some of the mitigation measure reported to have been applied remain in question. Issues about the effectiveness of surveillance, the limit of skilled man power and the progress of AICP remain.

There is a lack of transparency about the progress made in the health care system regarding the capabilities of human and animal disease diagnostic laboratories. The diagnostic capability enhancement of NPHL remains in question. Until the NPHL capacity is enhanced or collaboration with national private or international organization for diagnosis question about Nepal has a high health profile or is immunized to the subtype will continue. Transparency and

open communication regarding the capabilities of the government needs to occur. Furthermore, the method of surveillance will be impeded. Screening of swine operation should be implemented. Table top or field exercise of pandemic planning should occur. No immunization campaign has been implemented and the country is still awaiting vaccine deployment from WHO.

This indicates management and leadership issues, contributing to a lack of effective mitigation measures. With WHO continuing to report additional cases in Southeast Asia, continue vigilance and reporting in Nepal should occur. The government of Nepal however needs to be better prepared for the unpredictable pandemic threat and its consequences.

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