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Zoonoses and Food Hygiene News, published four times a year, provides a medium for disseminating technical information on matters related to zoonoses and food hygiene generated in the world, particularly in Nepal. The editors welcome submissions on these topics with appropriate illustrations and references. The views and opinions expressed in the News are those of the authors.

CONTENTS:

Identification and Assessment of Socio-Environmental Risk Settings for Japanese Encephalitis (JE) Transmission and Re-Emergence in Nepal

Activities carried out by NZFHRC

- Japanese Encephalitis Implementation Coordination Steering Committee Meeting and Japanese Encephalitis Implementation Stakeholder Coordination Committee Meeting were organized by National Zoonoses and Food Hygiene Research Centre (NZFHRC) with the support of International Development Research Centre (IDRC), Ottawa, Canada in the following districts:
    1. Kathmandu,
    2. Morang
    3. Rupandehi
    4. Kapilbastu
- NZFHRC resources persons were presented work plan of the project period i.e. September 2011 to August 2014 in this meeting.
- Kathmandu: NZFHRC had conducted the Japanese Encephalitis Implementation Coordination Steering and Stakeholders Committee (JEICSC) Meeting in the 4 different JE project districts i.e. Kathmandu, Morang, Rupandehi and Kapilbastu. Dr. D. D. Joshi, Executive Chairman was the chairman of the entire Programme.
- The main goal of the steering and stakeholders committee meeting was to let the steering committee members and stakeholders know about NZFHRC in the joint venture with Center for Coastal Health (CCH), British Columbia, and Canada work plan of the three years project entitled **"Identification and Assessment of Socio-environmental Risk Settings for JE Transmission and Re-Emergence in Nepal".** The project was funded by International Development Research Center (IDRC), Ottawa, Canada.
- The Japanese Encephalitis Implementation Coordination Steering Committee (JEICSC) Meeting was conducted at The Hotel Himalaya, Kupondole on 24th Oct, 2011. Dr. Andres Sanchez, Senior Programme Specialist, IDRC, Canada was the chief guest of the Steering Committee Meeting.
- The Japanese Encephalitis Implementation Coordination Stakeholders (Group A-B) Committee (JEICSC) Meeting was conducted at National Zoonoses and Food Hygiene Research Center (NZFHRC), Chagal, Kathmandu on 25th Nov and 3rd Dec, 2011 respectively. Dr. Baburam Gautam, Chief, Medical Officer, Kathmandu Metropolitan City (KMC), Public Health and Social Welfare Department was the Chief Guest of the Programme (Group-B).
- The Japanese Encephalitis Implementation Coordination Steering and Stakeholders Committee (JEICSC) Meeting was conducted in Swagatam Hotel, Biratnagar on 16th - 17th Nov., 2011 respectively.
- Similarly, the Japanese Encephalitis Implementation Coordination Steering and Stakeholders Committee (JEICSC) Meeting were conducted in Hotel Moonlight, Bhairahawa on 8th Dec. and 10th Dec. 2011. Mr. Hari Krishna Poudel, Chief District officer (CDO), Rupandehi was the Chief Guest in the steering committee meeting.
- The Japanese Encephalitis Implementation Coordination Steering and Stakeholders Committee (JEICSC) Meeting was conducted in District Livestock Office's meeting hall in Taulihawa, Kapilbastu on 9th Dec. and 11th Dec. 2011 respectively. Dr. Kamleshwar Sinha, Chief District officer was the Chief Guest in the steering committee meeting.
- In addition, the members of Steering Committee meeting were Medical Doctors, Veterinarians, Virologist, Epidemiologist, Microbiologist, District Public Health Officer, zoonotic disease control officer, Entomologist and others. The other activities were to follow the proposed plan with the help of key members and work smoothly with the plan and motivation. The concept of **"One health, One Medicine"** was discussed in the meeting. The meeting was very fruitful where the members were enthusiastic to help our project.
- Similarly, the stakeholders were personnel from District Public Health Office, and Nurses/Clinic incharge from different hospitals and clinics of Morang district, JT/JTAS from District Livestock Services Office, Pig farmers from JE vulnerable areas. The other goals were to disseminate the knowledge about Japanese Encephalitis to the stakeholders and to collect the serum samples of the suspected JE cases in their clinic for conducting JE rapid test in NZFHRC center. In addition, the meeting was also held to discuss on the site selection for pig sero-surveys,

pig farmers survey, mosquitoes survey and household and gender surveys. The suggestions and information that are gathered from stakeholders during the discussion were praiseworthy.

- In conclusion, JE Implementation Coordination Steering and Stakeholders Committee conducted by NZFHRC was remarkable and the members of Steering and Stakeholders committee were enthusiastic to cooperate us for the 3 years long term JE project. The following papers were presented during the entire programme:

  - Japanese Encephalitis (JE) Project Outline: Formulation of JE Implementation Coordination Steering Committee by **Dr. D. D. Joshi**, Dr. Craig Stephen, Ms. Minu Sharma and Dr. Erin Fraser
  - JE Situation in Nepal: Epidemiological Data Collection and Analysis by **Dr. P. B. Chand**, Dr. D. D. Joshi, Dr. Craig Stephen, Dr. Erin Fraser, Dr. Eleni Galanis and Ms. Minu Sharma
  - Pig population study and pig blood sample collection by **Dr. Anita Ale**, Dr. D. D. Joshi, Dr. Craig Stephen, Dr. Eleni Galanis, Ms. Minu Sharma and Mr. Santosh Dhakal
  - Project area district profile preparation by **Mr. Bijaya Shrestha**, Dr. D. D. Joshi, Dr. Craig Stephen, Ms. Minu Sharma, Dr. Colin Robertson, Ms. Meena Dahal and Ms. Kabita Shahi
  - Household Survey and Identifying Socio Environmental Factors Responsible for JE: Ecosystem health approach method to be applied like PAR tools, stakeholder training, gender training by **Ms. Minu Sharma**, Dr. D. D. Joshi, Dr. Craig Stephen, Dr. Colin Robertson, Dr. Kent Hecker, Dr. Tim Dejager and Ms. Meena Dahal
  - JE Vector Culicine Species of Mosquito Survey: Collection, Identification and Preservation by **Mr. Shishir Pant**, Dr. D. D. Joshi, Dr. Craig Stephen, Dr. Eleni Galanis and Ms. Minu Sharma
  - JE mortality and morbidity case survey: Clinically JE cases admitted in the hospital of the four project districts, cost of treatment and then vaccination by **Dr. Siddhartha Joshi**, Dr. D. D. Joshi, Dr. Craig Stephen, Dr. P. B. Chand, Dr. Eleni Galanis, Ms. Minu Sharma and Dr. Jane Parmley
  - Data survey, data collection, classification, coding and analysis by **Mr. Dhan Kumar Pant**, Dr. D. D. Joshi, Dr. Craig Stephen, Ms. Meena Dahal, Ms. Minu Sharma, Dr. Kent Hecker, and Dr. Tim Dejager
  - ELISA test for human serum, pig serum and well fed mosquitoes samples – **Mr. Yogendra Shah**, Dr. D. D. Joshi, Dr. Craig Stephen, Dr. Anita Ale, Ms. Kabita Shahi, Ms. Indira Mainali, Dr. Erin Fraser

- Survey questionnaires were developed pretested in the filed and all questionnaires were edited and corrected by Prof. Dr. Craig Stephen and his group from CCH, Canada. These questionnaires are listed as below:
  - Questionnaire to pig farmers
  - Hospital case control study
  - Demography household survey questionnaire
  - Questionnaire for the gender

Geographical expansion of Japanese encephalitis and research needs in Nepal

Santosh Dhakal & DD Joshi

Abstract

Since late 1980s Japanese encephalitis has been endemic in Terai and inner Terai region of Nepal (60-300masl). After the first report from Kathmandu valley in 1997, this disease also reported from other districts of Hill region (300-2000masl). Beyond the conventional logic of high altitude, the mountain districts (2,000-8,848masl) previously silent for this disease also started reporting cases from 2005. Till now 54 out of 75 districts of Nepal have reported Japanese encephalitis cases and the number of districts endemic for this disease are increasing. Presence of mosquito vector and infection in pig reported from those hill and mountain districts are also confirming the geographical expansion of Japanese encephalitis, making this disease a public health concern in Nepal. However, the transmission pattern is complex and not yet clear. Heavy rice farming under flooded irrigation, inflated pig husbandry without sanitary considerations, climate change favoring adaptation of vectors to hitherto cold climates, lack of awareness and preventive measures are regarded responsible for this expansion. A huge gap existing on geographical expansion of Japanese encephalitis calls for extensive research focusing on association of this disease with land use pattern, pig husbandry, vector ecology, human-animal interaction, socio-economic aspects of Japanese encephalitis risk and so on.

Keywords: Japanese encephalitis, Geographical expansion, Mosquito vector, Nepal

Introduction

Japanese encephalitis is a mosquito borne zoonotic disease caused by an arbovirus of flaviviridae family (Lindenbach *et. al.,* 2001). It is the single largest cause of viral encephalitis in the world (Khinchi *et. al.,* 2010), with annual case reports ranging from 30,000-50,000 (Solomon T., 2006). However, JE being an underreported disease, cases have been estimated to be more than this (Tsai T.F., 2000). Ardeid wading birds are the primary maintenance hosts, pigs are the main amplifying hosts, *Culex* mosquitoes are the primary mosquito vectors and humans are the dead end host for this disease (Hurk van den *et. al.*, 2009). Though most prevalent in Southeast Asia and the Indian sub-continent (Umanei *et. al*., 1985); its geographic range is expanding. The transmission pattern of JE is highly dynamic and influenced by a combination of fluctuating socio-environmental factors due to which, it is likely to be a global pathogen (Ghosh and Basu, 2009).

Methodology

Different journal articles related to Japanese encephalitis available online and published and unpublished materials of governmental sources related to Japanese encephalitis in Nepal were reviewed for preparation of this review paper.

Results

Epidemics of Japanese encephalitis virus (JEV) travelled northward in India and began to appear in Nepal in the late 1970s (Henderson *et.al*., 1983). JE was first diagnosed clinically in 1978 from Rupandehi district that lies in Terai region; 109 m above sea level (Joshi D., 1983). Total cases admitted in hospitals that year were 422 (Khatri et al., 1981). From its first outbreak, JE has been endemic in Terai and inner Terai districts of Nepal (Pant S., 2009). Disease distribution pattern observed till now has revealed that cases occur in outbreak proportion epidemic peaks in every 2-5 yrs (Bista and

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Shrestha, 2005). Bista and Shrestha (2005) reported that a total of 26,667 cases and 5,381 deaths occurred from Japanese encephalitis disease in Nepal within the 25 year period (from 1978-2003) with 20.2% average case fatality rate. In 2004, a total of 371 cases of JE were reported throughout the country (Pant S., 2009). Previously, all viral encephalitis cases were reported as JE and only after May-2004 under the support of WHO, Nepal started surveillance for acute encephalitis syndrome (AES) and captured JE cases from AES. The number of AES cases and JE cases with respective deaths and case fatality rate after 2005 to October 2011 are presented on table 1.

Year	Acute Encephalitis Syndrome (AES)			Japanese Encephalitis		
	Cases	Deaths	CFR%	Cases	Deaths	CFR%
2005	2887	336	11.6	669	53	7.9
2006	1484	108	7.3	295	42	14.2
2007	1657	123	7.4	442	61	13.8
2008	1989	81	4.1	339	39	11.5
2009	1487	41	2.8	147	2	1.4
2010	1614	26	1.6	179	1	0.6
2011*	888	6	0.7	47	0	00
Total	12006	721	6	2118	198	9.3

(Source: WHO, IPD, Nepal.) *as data of 15 October, 2011.

Japanese Encephalitis has been confirmed in all age groups in Nepal, though in other country it has been reported as a disease of children (Vaughn and Hoke, 1992). Almost 50 % cases occur in 15 year or younger age group with high incidence in 5-15 years. It is more common in males (60%) than in females, probably due to greater exposure during the mosquitoes feeding hours (Akiba *et. al.*, 2001 and Patridge *et. al*, 2007). Though cases of Japanese encephalitis are reported throughout the year, upsurge of cases takes place after the rainy season (monsoon) (Bista and Shrestha, 2005). Monsoon rain supports for intensive agriculture, including rice growing. Rice fields supports the breeding of *Culex tritaeniorrynchus,* the major vector of Japanese encephalitis (Bista *et. al*., 2001). When mosquito population becomes adequately high, JEV transmission spills over from the mosquito-bird-pig cycle into human population (Impoinvil *et al*., 2011). Incidence is highest between July to September each year. The outbreak peaks during August. Limited cases of JE are then reported from November to March (Pant S., 2009). Akaiba *et. al*. (2001) reported that in 1997 (one of the worst epidemic of Nepalese history) JE out break started in 1st week of August and peaked in the first week of September (2-8 September), which ended in last week of October after a duration of twelve week.

Regarding the geographical expansion of JE in Nepal, Zimmerman *et.al.* (1997) reported the first proven cases from Kathmandu valley, which has altitude of 1300 meters. They also re-analyzed 44 pig sera (previously collected for hepatitis E serology from free roaming swine of Kathmandu valley and stored frozen) for IgM test against JE virus infection and found 23 of 44 pigs positive. Basnyat *et. al*. (2001) mentioned about the persistency of JE in Kathmandu after first report of 1995. According to them, there were 3 positive cases in 1996 and 9 positive cases in 1998. Patridge *et.al.* (2007) first studied about the endemicity of JE in Kathmandu valley. In their study, they followed up the all lab confirmed cases of JE in Kathmandu valley in 2006 to collect information of residency and travel history and found 40/48 cases being resident of valley itself. Among 40 cases with confirmed residency in the Kathmandu valley, 30 had no history of travel outside the valley 30 days before the onset of illness.

Through AES surveillance system other districts of hills and mountains were also reporting cases continuously. From 2004 through 2006, a total of 108 laboratory confirmed JE cases were reported from hill or mountain districts excluding Kathmandu valley. However, travel histories for case-patients were not available for these years to determine the origin of JE infection (Bhattachan *et. al.,* 2009). Bhattachan *et. al*. (2009) made the first attempt for finding out the endemicity of JE cases in hill and mountains. They selected 52 districts of hills and mountains out of 55 (excluded Kathmandu, Bhaktapur and Lalitpur of Kathmandu valley) for their study. In 2007, a total of 360 AES cases were reported from 40 hill or mountain districts out of 52 districts under study. Of the 344 reported AES cases, 90 were laboratory confirmed as JE from 21 hill and 3 mountain districts. All patients confirmed for this disease were visited at home or telephoned to confirm their residency and travel history during the 30 days before the onset of symptoms. After the study they concluded that JEV is also a cause of acute encephalitis in hill and mountain districts in endemic form. The presence of both JE vectors and amplifying hosts were already confirmed in the hill region (Zimmerman *et.al.,* 1997). Pant Shushil Dev (2009) has mentioned 2 and 4 cases of JE being reported from mountain region and 76 and 153 cases reported from hills during 2006 and 2007 respectively.

Through ongoing surveillance system for AES, JE has now been documented to be endemic in the Kathmandu Valley as well as other 24 districts (Bhattachan *et. al.,* 2009) and cases have been detected in a total of 54 districts in Nepal (Pant S., 2009). Thakur Krishna Kumar (2011) conducted a cross-sectional survey from July- August of 2010 in four mountain districts (Sindhupalchowk, Dolakha, Solukhumbu and Kavrepalanchowk) known to have human cases of JE. A total of 454 pig serum samples were collected and tested by competitive ELISA. Results showed that 16.7% (17/102), 4% (4/100), 6.6% (10/151) and 44.6% (45/101) of pigs had anti-JEV antibodies in Sindhupalchowk, Dolakha, Solukhumbu and Kavrepalanchowk districts respectively, suggesting for probable endemicity of JE in these districts.

Discussion

The conventional logic doesn't make the high altitude zones be vulnerable for vector borne diseases like Japanese encephalitis. But, the case is just opposite for Nepal. Year after year evidence of JE cases from hills and mountains with no history of travel to endemic districts before illness by the patients have confirmed the endemicity of disease in different ecological system in Nepal. It has been suggested that the shifts in JE case distribution may be due to 1) the mass immunization campaigns conducted in Nepal, which have been introduced since 2006 and are being conducted in a phase-wise manner starting with highest priority districts assigned by Nepal Ministry of Health and Population or 2) conferred widespread immunity resulting in fewer susceptible people in the Terai (Patridge *et al.,* 2007). Whatever the reason be, the geographical expansion and high mortality and disability rates have made this disease a public health priority for Nepal. Transmission pattern of JE is still not fully understood in this developing country. Based on the literatures and trend of cases the following variables can be regarded as the driving factors for spread or re-emergence of Japanese encephalitis in Nepal:

- Land use pattern for rice cultivation: Rice farming is being practiced in all districts except few mountain districts serves better breeding site for mosquito vector.
- Pig husbandry: Government of Nepal has been prioritizing pig farming as the potential means of alleviating poverty. The small investment and lucrative profit of pig farming has attracted all, from marginalized to opulent, in this sector. The farms are however, maintained under unsanitary practices.
- Global warming/climate change and vector adaptation to new climates.
- Human animal bonding: Pig farm is close to human dwelling/people sleep close to pigs.
- Poverty, access to health care and culture: Like other tropical disease, Japanese encephalitis also disproportionately affects the

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poor more frequently and more severely. Most cases may have gone unidentified in high altitude zones due to lack of access to health care facilities in reach of all.

- Lack of awareness and preventive measures

Vaccination started in high endemic region of Terai has given impressive results in Nepal but many things are still to uncover like (1) How long does it give immunity? (2) Whom to vaccinate? (Whole population or children only) (2) Whether to expand to other districts or not? (Include all 54 districts or not?) (4) Can Nepal afford vaccination? Or is it sustainable?, because if this geographical expansion pattern continues cases are likely to be reported from other districts until now silent for this disease. In these circumstances government of Nepal needs to develop short term, mid term and long term strategies for JE prevention and control. The prevention and control strategy should mainly focus on (1) Health education and training (2) vector control (3) immunization of pigs and human and (4) epidemic preparedness and response. A huge gap still exists about the information of transmission pattern of JE in Nepal. This calls for extensive and intensive research with special focus on (i) association of JE and land use pattern; (ii) association of JE and pig husbandry; (iii) study of vector ecology; (iv) JE from climate change perspective; (v) JE and human-animal interaction; (vi) Poverty , culture and other socio-economic aspect of JE risk and so on.

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News:

K.D.M.A. Research Award:

Please kindly submit your research work paper on allergy award for the year 2010 for the consideration by the end of December 2011 to KDMART office Chagal, G.P.O. Box 1885, Kathmandu, Nepal, Phone: 4270667, 4274928 and Fax 4272694. This award was established by Dr. D. D. Joshi in 2049 B.S. (1992) on the memory of his wife, the late Mrs. Kaushilya Devi Joshi. The award includes a grant of NCRs. 10,001 with certificate.

From: Zoonoses & Food Hygiene News, NZFHRC
P.O. Box 1885, Chagal, Kathmandu, Nepal.

TO:

Dr/Mr/Ms .....

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