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CONTENTS:

Study on Comparative Knowledge and Public Health Impacts of Japanese Encephalitis among Pig Raising and Non-raising Community Members of Rupandehi, Nepal

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A household and pig survey to describe the knowledge of Japanese Encephalitis (JE) was conducted from May to November 2012 in Rupandehi district Nepal. Samples from one hundred household (HH, 50 pig raisers and 50 pig non raisers) were taken to compare JE risk factors; and 100 pig farmers were selected randomly to study roles of pigs as risk factor for JE in. Altogether 54% of respondents heard about JE with 60% (30/50) in pig raisers and 48% (24/50) in pig non raisers, which was not significantly different (p>0.05). The media like Radio, TV, were found the most important source of information. The knowledge of JE was found significantly higher (p<0.05) in adult people (16-40 yr). The important predictors for knowledge of JE were access to media, education, and age of respondents. In next 100 pig farmer's survey, 84.5% of pig farmers had seen mosquitoes in pig shed and 52% had seen mosquitoes biting pigs. Most farmers (68%) saw mosquitoes biting pigs everyday and major biting time was dusk (49%) and night (39%).There was a significant association between knowledge on JE and their practices to avoid mosquitoes in pig shed (p<0.01). Although the community members were at risk of JE but none of them were vaccinated against JE. Pig farmers vaccinated their pigs against infectious diseases like Foot & Mouth Disease and Swine Fever (44%) but none had vaccinated their pigs against JE.
Key words: JE, knowledge, risk factors, vaccination, Rupandehi.

Introduction

Japanese Encephalitis (JE) was first clinically identified in 1871 in Japan and known as "summer encephalitis" (Mechenzie *et al.,* 2007). The virus responsible for Japanese Encephalitis B (JEB) was re-isolated and ultimately characterized in 1934, when it was experimentally inoculated into monkey brain to reproduce the disease successfully (Jani, 2009). JE appeared endemic within the Indochinese Peninsula including Cambodia, Laos, Thailand, Vietnam, Malaysia, Burma, along with rare cases in Singapore and Brunei (Erlanger *et al.,* 2009). Within the following four decades, JE has subsequently occupied most of the Asian continent including Pakistan, Sri Lanka (Solomon *et al.,* 2000), Bangladesh and Nepal (Joshi, 1983).

Ardeid wading birds are the primary maintenance host, pigs are the main amplifying hosts, and *Culex* mosquitoes are the primary mosquito vectors (Igarashi, 2002) for JE virus. The disease was first recorded in Nepal in 1978 as an epidemic in Rupandehi and Morang (Joshi, 1983).The major objective of this research was to study knowledge and attitude of community members towards JE, to assess its risk factors and current practices to avoid it.

Materials and methods

Rupandehi is a western Terai district of Nepal that shares its boundary with JE endemic district of northern India, the Utter Pradesh. Rupandehi was chosen a study site because it is an endemic district for JE (DHS, 2007), many community members have frequent mobility to India (DDC, 2010) and live pigs are imported from Indian endemic region to Nepal (DLS, 2010). Two study communities named Charange and Majuwa were selected as per the information on risk factors relating to JE from District Livestock Stock Office, District Hospital and Zonal hospital. The Charange and Majuwa were dense pig populated area of Rupandehi (DLSO, Rupandehi, 2011). To study knowledge, attitude and risk factors of JE, a semi structured questionnaire survey was conducted through oral interview with household head in both pig raisers and non raisers from May to November, 2012. The HH head with the age between 16 to 40 years were considered adult and above 40 were considered older respondents. The survey included 50 pig raisers and 50 pig non raisers totaling 100 households. Another similar survey was conducted among 100 pig farming HH to know risks factors for JE like presence of mosquitoes in pig shed, mosquito bites of pigs and HH members and practices to avoid those bites.

Result

Fifty four percent (54/100, 95% CI: 44.2 to 66.6%) of the respondents heard about JE which was 60% (30/50, 95% CI: 46 to 72.8%) in pig raisers and 48% (24/50, 95% CI: 34.5 to 61.8%) in pig non raisers indicating a non significant difference among two respondent types. The media (television and radio) were found to be mostly used information source (56%) for JE and other vector borne diseases (VBDs) followed by health personnel (26%) and formal academic study (18%). Only 50.9% (28/54) of the respondents who heard of JE knew about mosquito as the vector, 50.9% (28/54) knew about its transmission cycle, and 49.1% (27/54) knew that JE could be treated. It was found that 50% of the community members were known about basic symptoms of JE (high fever, severe headache, neck rigidity and vomiting). The pig raisers were found to be less careful on the practices to avoid mosquito bite. The knowledge on JE was associated significantly with age ($\chi^2 = 3.931$; $p = 0.047$, Table 1) as more adults (65.8%) knew well about JE than the older (45.76%). The access of HH to radio and television was the best predictor of knowledge on JE compared to education status and age factor.

Table 1. Association of respondent characteristics to knowledge of JE in community members of Rupandehi

Respondent type	Knew about JE	Didn't know about JE	Chi square (P value)
Adult	27 (50%)	14 (30.4%)	3.931 (0.047)
Older	27(50%)	32 (69.6%)	
Access to TV, radio	52 (96.3%)	36 (78.3%)	7.651 (0.006)
No access to TV, radio	2 (3.7%)	10 (21.7%)	

In next 100 pig farmer's survey, 84.5% of pig farmers had seen mosquitoes in pig shed and 52% had seen mosquitoes biting pigs. Most farmers (68%) saw mosquitoes biting pigs everyday and major biting time was dusk (49%) and night (39%). Similarly, one third (33%) of pig raisers applied practices like disinfection, fumigation outside building, and removing stagnant water to avoid mosquitoes while the remaining 67% had done nothing. Half of farmers (50/100) reported being bitten by mosquito while working in the pig farms, 15% were in doubt, but 35% didn't suffer from mosquito bite. Only 44 (44%) of them had vaccinated their piglets against few infectious diseases like Swine Fever, FMD but none of them had vaccinated against JE. There was a significant association between knowledge on JE and their practices to avoid mosquitoes in pig shed (χ^2 = 10.684; p = 0.001, Table 2).

Table 2. Association of farmers' mosquito avoidance practices in pig shed to knowledge of JE

Pig farmer practice	Knew about JE	Didn't know about JE	Chi square (P value)
Avoid mosquito	20(52.6%)	13 (21%)	10.684 (0.001)
Don't avoid mosquito	18(47.4%)	49 (79%)	
Total pig farmers	38	62	

Discussion

Risk factor of JE among community members

In community member at Rupandehi, 54% (54/100 of respondents knew about JE which was found higher than that of Morang (USAID, 2003) where 32% of respondent were aware of JE. As per the research of Pandit (2010), in Mandya district of Karnataka, about 42% of respondents had knowledge of JE and in Koppal district, 19.85% of the heads of household had the knowledge of JE. Similarly, 38% of the respondent pig farmers in Rupandehi had known about JE which supports the knowledge in pig farmers of Kathmandu (42%) (Dhakal *et al*., 2012) and contrast among in pig farmers (10%) of mountain districts (Thakur *et al.*, 2012) of Nepal. This variation of knowledge might have been influenced by the socioeconomic and education status of respondents (USAID, 2003). The lower level of knowledge in Kapilvastu might have been due to low economic and education status. The major source of information regarding VBDs were found to be media like radio and television. Similar findings were reported by USAID (2003) as they had found that knowledge and awareness of VBDs increased with radio ownership. The younger age, high literacy rate and access to the media were found important predictors for Knowledge on JE. According to report of CDC (2011) 40% of respondent (20/50) got bite while working in the field and 60% while in house at different time which is similar to this finding. The mosquito bite of human, time and frequency of biting in pig shed are important for disease dynamics. In similar research of USAID (2003), 85% used bed nets among those aware of JE compared to 68% among those not aware. The lack of knowledge on JE is thus one of its major risk factors.

Conclusion

The knowledge regarding JE in pig raisers was higher compared to pig non raisers but was not sufficient. People were unaware of its public health importance. Many pig farmers were illiterate so the training and demonstration regarding the piggery management, zoonotic diseases from pigs, measures to be prevented from vector borne diseases like JE should be provided. The vaccination programs for JEV in pigs should be launched along with the other vaccination like FMD, Swine fever in disease endemic area. This is an important public health disease as governed by many social, economical and environmental factors. Therefore, the integrated management of the virus both in animals and human could be the best public health policy to reduce and ultimately eliminate it.

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Role of Wildlife Particularly Birds in Zoonotic Disease Transmission

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Information on zoonotic diseases

Zoonotic diseases refer to the diseases and infections that are transmitted naturally between vertebrate animals and human. The causative agent can be a bacterium, virus, fungus, parasite, or other communicable agent. More than 60% of human infectious diseases are caused by pathogens shared with wild or domestic animals. These zoonotic pathogens are responsible for a substantial burden of disease causing about a billion cases of illness in people and millions of deaths every year (Karesh et. al., 2012).

Zoonotic disease transmission

The emergence of zoonoses can be taken as the logical consequence of pathogen ecology and evolution, as microbes exploit new niches and adapt to new hosts. The underlying causes that create or provide access to these new niches seem to be mediated by human action in most cases, and include changes in land use, extraction of natural resources, animal production systems, modern transportation, antimicrobial drug use, and global trade. Domestication of animals, clearing of land for farming and grazing, & hunting of wildlife in new habitats have resulted in zoonotic human infection with microorganisms that cause diseases such as rabies, echinococcosis, and the progenitors of measles and smallpox that had historically affected only animal populations through changes in contact and increased transmission opportunities from animals to people (Karesh et. al., 2012).

Role of wildlife in zoonotic disease transmission

Today, zoonoses with a wildlife reservoir constitute a major public health problem all over the world. The importance of such zoonoses is increasingly recognized, and the need for more attention in this area is being addressed. Zoonoses with a wildlife reservoir are typically caused by various bacteria, viruses, and parasites, whereas fungi are of negligible importance (Kruse et. al., 2004). Various factors are responsible for emergence of zoonotic pathogens like the burgeoning human population, increased local and international travel, and increased trade of animal and animal products, changing agricultural patterns etc. which favor the transfer and/or intermixing of pathogens between wild and domestic animals and with the human host (Bengis et. al., 2004).

Disease like tularemia is directly transmitted from wildlife to humans while rabies like disease is transmitted by bite (saliva) from rabid animal, Hantaviruses are spread by aerosols, similarly food borne pathogens like *Salmonella* and *Leptospira* spread through contaminated food and water. Rift Valley fever, equine encephalitis, and Japanese encephalitis are spread through insect vectors like mosquitoes (Kruse et. al., 2004). There are two distinct patterns on zoonotic disease transmission from wild animals to humans. In the first pattern, actual transmission of the pathogen to humans is a rare event but, once it has occurred, human-to-human transmission maintains the infection for some period of time or permanently. An example of this type of transmission is seen in human immunodeficiency virus/acquired immune deficiency syndrome, influenza A, Ebola virus and severe acute respiratory syndrome. In the second pattern, direct or vector-mediated animal-to-human transmission is the usual path. Wild animal populations are the principal reservoirs of the pathogen and human-to-human disease transmission is rare. Examples of pathogens with this pattern of transmission include rabies and other lyssaviruses, Nipah virus, West Nile virus, Hantavirus, and the agents of Lyme borreliosis, plague, tularemia, leptospirosis and ehrlichiosis. These zoonotic diseases from wild animal sources all have trends that are rising sharply upward (Bengis et. al., 2004).

Wild birds in zoonotic disease transmission

Birds are important to public health because they carry emerging zoonotic pathogens, either as reservoir hosts or as agents dispersing infected arthropod vectors. In addition, bird migration provides a mechanism for the establishment of new endemic foci of disease at great distances from where an infection was acquired (Reed et. al., 2003). Major zoonotic infections of wild birds in North America are listed in table below.

Table: Major zoonotic infections of wild birds in North America

Disease	Microorganism (s)	Bird Species
Viral encephalitis*	Arboviruses -West Nile virus -Eastern Equine **Encephalitis virus** -St. Louis encephalitis virus - Western equine encephalitis virus	Numerous species (>110) Crows, Jays, and Raptors are sentinel species
Lyme disease*	*Borrelia burgdorferi* sensu stricto	Numerous species of songbirds and waterfowl
Influenza*	*Influenza A* Virus	Waterfowl
Enteropathogens*	*Salmonella spp* *Campylobacter jejuni* Glycopeptide resistant *Enterococcus*	Numerous species of songbirds, gulls, and waterfowl
Mycobacteriosis	*Mycobacterium avium* *Mycobacterium genevense*	Numerous species
Chlamydiosis	*Chlamydia psittaci*	Psitacine birds, pigeons, poultry

*Organisms on the National Institute of Allergy and Infectious Diseases list of emerging infectious diseases

Birds and avian influenza

Avian influenza (AI) viruses circulate among birds worldwide. Certain birds, particularly water birds, act as hosts for influenza viruses. Susceptible birds can become infected with AI virus when they have contact with contaminated nasal, respiratory, or fecal material from infected birds. Most often, the wild birds that are host to the virus do not get sick, but they can spread influenza virus to other birds. Infection with certain avian influenza A viruses (for example, some H5 and H7 strains) can cause widespread disease and death among some species of domesticated birds (CDC, 2008). Although the H5N1 AI virus has been detected across a diverse range of free-ranging wild species (over 75 species of wild birds from 10 different avian orders), it is wetland or aquatic species that are the most frequently recorded. Birds with affinities for wetland habitats make up nearly 60% of the wild species infected with the H5N1 virus and also account for the greater proportion of wildlife mortalities. As the most frequently detected wild hosts of the H5N1 virus, wetland birds represent an appropriate target for active disease surveillance. Birds such as ducks, geese, swans, gulls, shorebirds, herons, egrets, storks, rails, coots, gallinules, cormorants and grebes are common wetland species (ftp://ftp.fao.org/docrep/fao/010/a1521e/a1521e02.pdf).

List of the avian taxa in which the H5N1 highly pathogenic avian influenza virus has been detected in wild and/or captive populations* (as of September 2007**)

Order family	Common species	Habitat preferred	Number of species H5N1 detected		
			Total	Wild	Captive
Anseriformes Anatidae	Ducks, geese, swans	Wetland, Marine	30	11	19
Charadriiformes Laridae Scolopacidae	Gulls Shore birds	3 1	3 1	3 1	2 0
Gruiformes Rallidae	Rails, coots	Wetland	4	4	0
Pelecaniformes Phalacrocoracidae	Cormorants	Marine, Wetland	2	2	0

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Podicipediformes Podicipedidae	Grebes	Wetland, Marine	2	2	0
Falconiformes Accipitridae Falconidae	Hawks, Eagles Falcons	General General	7 2	5 1	2 2
Passeriformes Corvidae Other	Crow, Ravens Song birds	General General	3 12	3 8	0 4
Galliformes Phasianidae	Pheasants, Partridge	General	4	2	2
Columbiformes Columbidae	Pigeons, Doves	General	2	2	0

*Captive birds include those held in a zoo or sanctuary. Some species may be included both as wild and captive ** Data source: USGS NHWC website (ftp://ftp.fao.org/docrep/fao/010/a1521e/a1521e02.pdf)

Birds and West Nile viral disease

West Nile virus is a mosquito-borne virus that can result in fatal encephalitis in humans, horses, and domestic and wild birds. This positive-stranded RNA virus belongs to the JE complex within the family Flaviviridae. Wild birds are central to the transmission cycle of WNV because they serve as amplifying hosts for the virus in nature. In the U.S., over 110 avian species, mostly songbirds, have been found to be susceptible to infection. The virus is passed from one bird to another by the bite of ornithophilic mosquitoes, generally *Culex spp*. Numerous other mosquito species have been shown to be competent vectors of infection (Reed et. al., 2003).

Birds and Japanese Encephalitis (JE)

Viremia and/or sero-conversion to JE Virus (JEV) has been observed in over 90 wild and domestic bird species belonging to a number of different avian species. However, ardeid wading birds are considered the primary enzootic hosts of JEV, and they can play a role in epizootic viral amplification in some areas (Buescher et.al., 1959 and Rodrigue et.al., 1981). Field studies by Buescher and colleagues (1959) established the role of ardeids in the ecology of JEV. Viremic migratory birds (Nga et. al., 2004) and even bats, especially fruit bats (Megachiroptera), may be involved in distant transport. In considering the expansion of genotype 1 in Asia, Nga and Others (2004) suggested that migratory birds could have important role in the importation of JEV into new territories.

Birds and some other zoonotic diseases

Birds are playing role in transmission of some zoonotic diseases. Some of these diseases include lyme disease, chlamydiosis, histoplasmosis, Newcastle disease, & enteropathogenic diseases. A number of bird species can be infected with *Borrelia burgdorferi*, the etiologic agent of Lyme disease, but most are not competent to transmit the infection to Ixodes ticks. The major role birds play in the geographic expansion of Lyme disease is as dispersers of *B. burgdorferi*-infected ticks. Wild birds can acquire enteropathogens, such as *Salmonella* and *Campylobacter* spp., by feeding on raw sewage and garbage, and can spread these agents to humans directly or by contaminating commercial poultry operations. Conversely, wild birds can acquire drug-resistant enteropathogens from farms and spread these strains along migration routes (Reed *et. al.,* 2003). Chlamydiosis (caused by *Chlamydia psittaci*) is a disease of birds that can also cause disease in humans. Birds or people generally contract parrot *Chlamydia* by inhaling particles of infected material shed by *Chlamydia* infected birds (CDC, 2012). Newcastle disease is a viral disease that can affect a wide variety of avian species, both wild birds and domestic fowl. In humans, the Newcastle disease virus can cause conjunctivitis (pink eye). Such cases occur occasionally in laboratory or farm workers that are not wearing protective eyewear (CFIA, 2012).

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NEWS

KDMA Research Award Awarded for the year 2011:

KDMA research award for the year 2068 B.S. (2011) was awarded to Ms. Laxmi Upreti, Mr. Phul Prasad Subedi, Mr. Vimal Gurung and Mr. Yuba Raj Adhikari for their research work titled **"Allergy Cases among Students, Teachers and Community People of Kuleshwor Area, Kathmandu"**.

K.D.M.A. Research Award:

Please kindly submit your research work paper on allergy award for the year 2012 for the consideration by the end of March 2013 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.

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