

Japanese Encephalitis Vaccination in Children Population of Nepal During the year 2005, 2006 and 2008

Joshi DD¹

¹Dr. Durga Datt Joshi, MPVM, FISCD, WHO Expert Panel Member on Zoonoses, Executive Chairman, National Zoonoses and Food Hygiene Research Centre (NZFHRC) GPO Box: 1885 Chagal, Kathmandu, Nepal. Jeevan Smriti Marg House no. 468 Ward no. 13, KMC Phone: +977-1-4270667, +977-1-4272694

Address for Correspondence: Dr. Durga Datt Joshi, E-mail: ddjoshi@healthnet.org.np

Abstract

Japanese Encephalitis (JE) is caused by a Flavivirus that, in a proportion of human cases, causes severe encephalitis leading to death or sometimes permanent disablement. It is a zoonotic disease, transferred from animals (commonly pigs or wild birds) by a mosquito vector to humans. In Southeast Asia it is thought to cause up to 50000 clinical cases and 10000 deaths per year. JE vaccination programme was carried out in high risk districts of Nepal. Japanese encephalitis vaccination was carried out during the years 2005, 2006, 2008 and 2009. The data collected from primary and secondary sources from the District Health Offices and other concerned central offices of the Department of Health Services, was tabulated and analysed. Thirty-five lakh of JE vaccine doses was procured by the Ministry of Health during the year 2006/2007. This vaccine was used in children under 15 years of age of 12 districts of JE risk and high-risk areas of Nepal. It was found that during the year 2005; 85% children in Banke and 81% in Kailali were vaccinated against JE. In Kailali and Banke districts it was found to be about 103% coverage in children population targeted, in Dang district it was 100% coverage, and in Bardiya district it was 73% coverage but in Rupandehi and Kanchanpur districts it was only about 40% and 41% respectively. JE vaccine coverage was very low in two Rupandehi and Kanchanpur districts during 2005 and 2006 and very high coverage during the year 2008. JE vaccination coverage results for the year 2009 have not been made available yet due to unavailability of data. This type of mass vaccination campaign needs regularity, mass awareness and health education programme should be carried out before JE vaccination campaign in the children in the future.

Key words: Japanese Encephalitis, flavivirus, zoonotic, vector borne, lyophilized vaccine.

What is the situation?

Nepal is one of the richest countries in the world in terms of bio-diversity due to its unique geographical position and altitudinal variation. The elevation of the country ranges from 60 m above sea level to the highest point on earth, Mr. Everest at 8,848 m, all within a distance of 150 km resulting into climatic conditions from Sub-tropical to Arctic mentioned by Nepal Tourism Board, 2006. JE cases are observed mostly in Terai area¹. In Southeast Asia it is thought to cause up to 50000 clinical cases and 10000 deaths per year². The earlier reports have shown that the case fatality rate

(CFR) is high in Nepal, and nationwide it has ranged from 15% to 46% for the years 1978 to 1994.

Japanese Encephalitis (JE) has been occurring in the South-East Asia and Western Pacific Regions for a long time. In Nepal, it has occurred first time in Rupandehi district then in Sunsari, Morang and latter in all 23 districts of tarai and inner tarai¹. Incidence of this disease has been recorded first time in different years in the following countries. Japan, China and Republic of Korea have reduced the incidence of this disease now².

Table 1: Historical Reviews of JE Outbreak Worldwide.

Japan	1949 to 1950
Egypt	1977
Republic of Korea.	1949 to 1958
China	1949
Malaysia	1955 to 1960
Indonesia	1955 to 1960
Philippines	1950 to 1955
Singapore	1955 to 1960
Bangladesh	1977
Vietnam	1958 to 1969
India	1955 (South), 1973
Burma	1974
(West Bengal), U.P. and Bihar	1978
Thailand	1969 to 1970
Sri Lanka	1968
Nepal	1978

The entomological survey conducted, in the month of May/June 1981, in the endemic areas of western region of Nepal, have recorded the prevalence of the following species such as (a) *Culex tritaeniorhynchus*, (b) *Cules Vishuni*, (c) *Cules Gelidus*, (d) *Culex fusecephalus*, (e) *Culex epidesmas* (f) *Culex bitaeniorhynchus* (g) *Mansonia annulefera* (h) *Mansonia indiana* (i) *Mansonia uniformis*, (j) few species of genus *Aedes*, genus *Armigeris* and genus *Anopheles*³.

These mosquitos can breed in sub-urban and peri-urban area provided the ecological condition similar to rural area are present^{3,4,5}.

Infected Population and Deaths from Japanese Encephalitis (JE) Disease in Nepal (EDCD/DHS)

High Risk Population	1 Core 25 Lakh
High Risk Population	(Below 15 Years) 55 Lakh
JE Cases	26658 people during the year 1978-2003
Death Cases	5370 people during the year 1978-2003
Mortality	5 to 25%
Incidence	50% (Below 15 Years)

In Nepal JE has been recorded and reported as a seasonal disease in Nepal. “Shrawan” (July and August) appears to have been the deadliest month for the Nepalese as far as human casualties from JE are concerned.

During the summer of 1983, 1152 people were immunized against Japanese Encephalitis at British Medical Hospital (BMH), Ghopa camp, Dharan Nepal⁴. This was the first use of the Biken killed lyophilized vaccine in the British Army. Three doses of 1 ml. (0.5 ml for children under 3 years) given 10 days apart produced a protective neutralizing antibody response (titre more than 1:10) in almost 90% of people. Two doses of vaccine however seemed inadequate in that less than 40% of people sero-converted. Side effects were minimal and trivial. Studies of neutralizing antibodies before vaccination showed up to 30% of Nepalese people tested were already immune due to previous in apparent infection while all but one of the British Nationals’ were fully susceptible.

What was done?

Epidemiology and Disease Control Division (EDCD) of the Department of Health Services, Ministry of Health and Population targeted to vaccinate 2,536,000 people of six Terai districts. The EDCD was prepared to vaccinate children between one and 15 years in age in Rupandehi and Kanchanpur districts and the whole population of Dang, Banke, Bardiya and Kailali districts during the year 2005 and 2006. During the year 2007 JE vaccination was not carried out in Nepal. Because of transferring process of this activity from DEE to Child Health Division (CHD).

EDCD launched an immunization campaign in June 2006 in six districts of Terai, which were most affected from Japanese encephalitis. Earlier one-dose vaccines were successfully given as a pilot project in two high risk districts Kailali and Rupandehi in 2005.

Kailali district is the most affected by the disease where vaccination campaign was started from July 2005 onwards according to the Districts Public Health Office. Seven lakh twenty five thousand three hundred ninety nine people have been targeted for vaccination programme for which 1229 vaccination centers were set up in Terai region for which 276 vaccination workers and 3700 volunteers were mobilized. It was conducted in; Kailali, Kanchanpur, Banke, Bardiya and Dang districts which were found to be most affected by encephalitis disease.

From the year 2008 onward Child Health Division, Immunization Unit of the Department of Health Services took the initiation of JE vaccination under routine immunization programme of the children. JE vaccination was done from the month of August to October 2008 in 12 districts of the country. From the month of January to March 2009 JE vaccination was given to the targeted children population of Udayapur, Bara and Rauthat districts.

What was found?

JE risk six districts population of children between 1 to 15 age, sex and sex ration in Nepal is presented in Table 2. Japanese Encephalitis (JE) Vaccination in Nepal during the year 2005 is presented in Table 3 and Fig 1. Banke and Kailali district population (745,099) are in high risk group for JE outbreaks. During the year 2005, 85% children in Banke and 81% in Kailali were vaccinated against JE. The second highest risk districts Kanchanpur, Bardiya, Dang and Rupandehi children population have got also JE vaccination during the year 2006 as shown in Table 4 and Fig 2. About 103% vaccination coverage in children population targeted were in Kailali and Banke districts and 100% coverage in Dang district, 73% in Bardiya district but in Rupandehi and Kanchanpur district 40 and 41% JE vaccine coverage respectively, which was very low coverage.

Total 310,200 children in Rupandehi, 180,500 in Kanchanpur, 534,000 in Dang 445,000 in Banke, 323,000 in Bardiya and 744,000 persons in Kailali districts had been administered the vaccine (See Table 3 and Fig 2).

About 1.5 million people benefited from the Japanese Encephalitis (JE) vaccine in six different districts of the Terai region. These districts are Kanchanpur, Kailali, Banke, Bardiya, Dang and Rupandehi.

The JE vaccinated achievement results of children population from Udayapur, Bara and Rautahat districts have not been made available yet for the year 2009. On an average JE vaccination coverage was 96% during the year 2008 with the number of targeted children population. However over 100% coverage is seen in 4 districts out of 9 districts (See Table 5 and Fig 3).

Table 2: JE Risk Six Districts Population of Children between 1 to 15 age, Sex and Sex ration in Nepal

Area	Age group	Total	Male	Female	Sex Ratio
Rupandehi	0-4 yrs	85964	43957	42007	1.05
	5-9 yrs	100724	51855	48869	1.06
	10-14 yrs	93215	48354	44861	1.08
	Total	279903	144166	135737	
Dang	0-4 yrs	59987	30284	29703	0.098
	5-9 yrs	67656	34279	33377	1.02
	10-14 yrs	65860	33411	32449	1.05
	Total	193503	97974	95529	
Banke	0-4 yrs	48809	24612	24197	1.06
	5-9 yrs	56410	28955	27455	1.02
	10-14 yrs	51041	26698	24343	1.03
	Total	156260	80265	75995	
Bardiya	0-4 yrs	47789	24246	23543	1.03
	5-9 yrs	58875	29670	29205	1.02
	10-14 yrs	52823	27215	25608	1.06
	Total	159487	81131	78356	
Kailali	0-4 yrs	79693	40843	38850	1.05
	5-9 yrs	95326	48698	46628	1.04
	10-14 yrs	86588	44590	41998	1.06
	Total	26160	134131	127476	
Kanchanpur	0-4 yrs	49777	25506	24271	.099
	5-9 yrs	55802	28545	27257	0.096
	10-14 yrs	52438	26790	25648	0.097s
	Total	158017	80841	77176	

Source: CBS 2001 population census.

Table 3: Japanese Encephalitis (JE) Vaccination in High Risk Targeted Children Population of Banke and Kailali District of Nepal during the Year 2005.

S. N.	High Risks district	Total targeted Children Population	Total Vaccination	
			Number	Percentage
1.	Banke	20,000	17000	85.0
2.	Kailali	7,25099	592147	81.7
	Total	745099	609147	81.8

Table 4: JE Vaccination in Nepal in Children of between one and 15 years in age during the Year 2006.

S.N.	District	Total children population targeted	Total Vaccination	
			Number	Percentage
1.	Rupandehi	768979	310200	40
2.	Dang	531613	534000	100
3.	Banke	429294	445000	103
4.	Bardiya	438159	323000	73
5.	Kailali	717067	744000	103
6.	Kanchanpur	434117	180500	41
Total		3319229	2536700	76

Table 5: JE Vaccination Campaign Coverage Report in 12 Districts of Nepal during the Year 2008.

S. N.	Name of Districts	# VDCs	# Municipalities	# Wards in Municipalities	Number of Immunized Population		Coverage in %
					Target Population (1-15 years)	Achievement (1-15 years)	
1	Saptari	114	1	10	272506	246704	91
2	Udayapur	44	1	17	140652	NA	-
3	Bara	98	1	14	270174	NA	-
4	Rautahat	96	1	13	261105	NA	-
5	Mahottari	76	1	13	243543	247538	102
6	Jhapa	47	3	47	304503	289043	95
7	Kapilvastu	77	1	14	214782	199460	93
8	Nawalparasi	73	1	13	251005	224253	89
9	Parsa	82	1	19	219493	212399	97
10	Chitwan	36	2	27	209400	212300	101
11	Lalitpur	41	1	22	151244	157012	104
12	Bhaktapur	16	2	34	100575	104094	103
Total		800	16	243	1967051	1892803	96

NA: JE vaccination report has not been made available by districts.

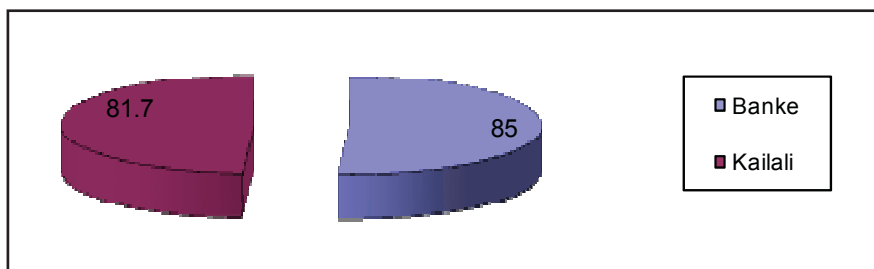


Fig 1: JE Vaccinated Children in Two High risk Districts Banke and Kailali during the Year 2005.

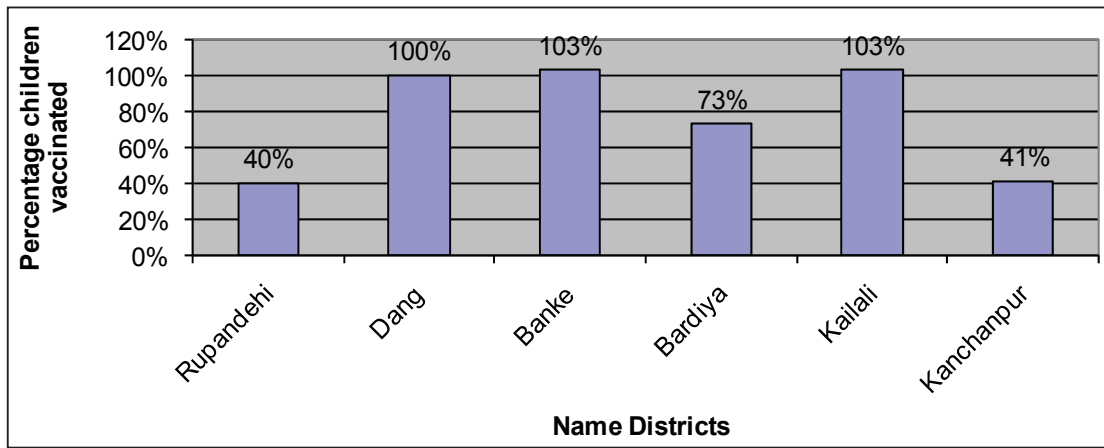


Fig 2: JE Vaccinated Children Population in Six Mid risk districts of Nepal during the Year 2006.

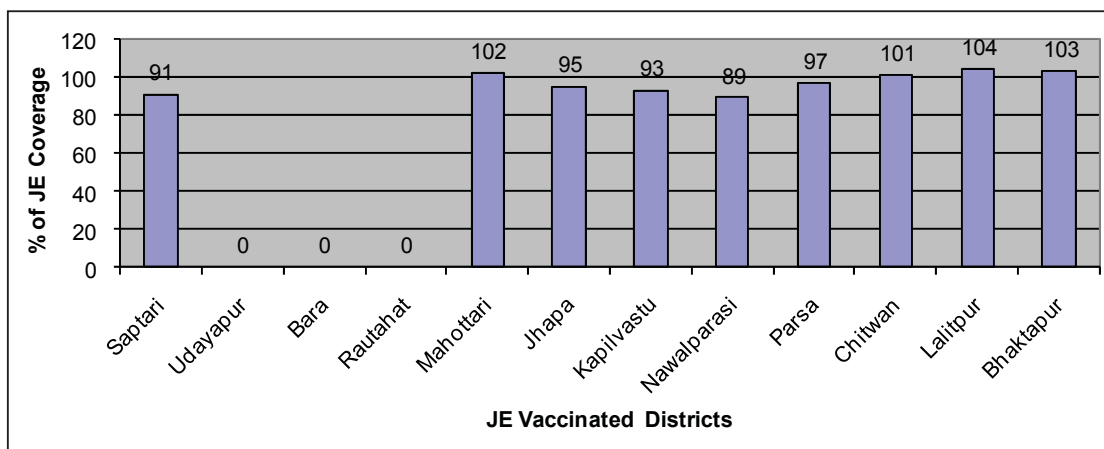


Fig 3: Percentage of JE Vaccination Coverage Children Population by districts during the Year 2008.

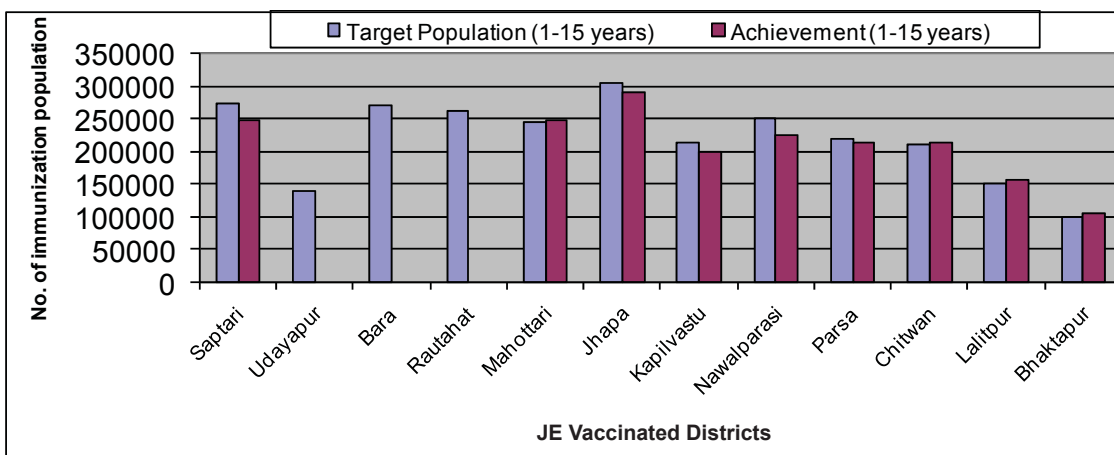


Fig 4: Comparison in number of JE Vaccinated Children Population with Targeted Population by district (2008).

The highest coverage in percentage of JE vaccination children population are 104% in Lalitpur, 103% in Bhaktapur, 102% in Mahottari and 101% in Chitwan, out of 9 districts with the targeted children population.

Number JE vaccination children targeted population versus with JE vaccinated achievement population is presented in Fig 4.

What needs to be done?

The earlier reports have shown that the case fatality rate (CFR) is high in Nepal, and nationwide it has ranged from 15% to 46% for the years 1978 to 1994⁶. It has been proved that JE virus causes encephalitis in humans and abortion in pigs while no symptoms in other animals and birds. Mostly children aged five to fifteen is victimized than adults. About fifty percent of the JE survivors are left with neurological syndrome and damage to the organs^{1,4,5}.

The people in the districts are dying due to Japanese encephalitis, and it threatens to assume epidemic proportions. The government has just started its second round of vaccination under mass vaccination program for the disease, which should have been completed by 2006. Because of the delay in vaccination, the number of patients suffering from Japanese Encephalitis may increase and take an epidemic form.

The vaccine "anti JESA-14-14-2 live attenuated" is produced in China and that it was found to be above 98 percent effective in Chinese children⁷. In Nepal, some two million people live in the Tarai regions considered to be highly affected areas. In order to prevent the epidemic, more than three million doses of vaccines had been arranged during the year 2005.

Vaccination campaign against Japanese encephalitis has been started in Banke district from 26 July 2006. It is said that all 422,000 people above one year of age from Banke district were vaccinated in the campaign, which would continue until August 18, 2006. The full dose vaccine has been provided by the district public Health office. According to the schedule, the campaign would remain until July 17, 2006 in Nepalgunj municipality and from July 27 to August 18, 2006 in 46 VDCs of the districts⁸.

The reduction in case incidence of Japanese encephalitis, in some countries like China, Japan and Korea has been achieved by applying certain measures such as; (Reference please)

- I. Mass vaccination of susceptible group of population,
- II. Vaccination of piglets of endemic areas,

- III. Anti-mosquito campaign, i.e. vector control measure both larva and adult.

Thirty-five lakh of JE vaccine doses was procured by the Ministry of Health during the year 2006/2007. The vaccine is made in China by Chengdu Institute of Biological Product. This vaccine will be used in children under 15 years of age of 24 districts of JE risk and high-risk areas of Nepal.

In Nepal twenty-four districts of terai are declared as JE prone disease area. About 12.5 million people in Nepal are in JE risk category. Children who are less than 15 years of age are more prone to suffer in case of a JE outbreak. In China, JE vaccination in children has shown 98.4% immunity which is very encouraging⁹. During the year 2007 about 35,00,000 doses of JE vaccine is going to be procured. So far about 5000 people died due to JE from the year 1978 to 2006. Every year 3000 to 4000 people yet risk and about 200-300 people die due to JE.

What has to be done?

For the reduction of JE cases in Nepal mass vaccination programme should be carried out every year for children in high risk districts of JE. Except symptomatic treatment there is no specific treatment for Japanese encephalitis. There are Japanese encephalitis vaccine prepared in Japan, China and USSR. There are two types of vaccines one liquid and other freeze dried. Vaccination can be done subcutaneously with two doses of 1 ml each above 3 years of age and 0.5 ml. for children upto 3 years of age at an interval of 7-14 days. Third doses should be given before one year. This will protect for 3 years in the endemic zone. One more booster dose after 3 years has been recommended which will give life long immunity to an individual¹⁰.

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Conflict of Interest: None.

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