(Final Report)

A Study on Socio-Economic Determinants and Economic Burden of Japanese Encephalitis in Kailali District of Nepal

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ACRONYMS:

CBS Central Bureau of Statistics

CBO Community Based Organizations

DALY Disability Adjusted Life Years

DPHO District Public Health Office

FCHV Female Community Health Volunteers

HDR/N Human Development Report, Nepal

HH Household

HMG His Majesty's Government

HP Health post

ILO International Labour Organization

IMF International Monetary Fund

JE Japanese Encephalitis

LHS Local Health System

PHC Primary Health Centre

SHP Sub-health Post

UNDP United Nations* Development Programme

VDC Village Development Committee

YDL Years of Life Lived with Disability

YLL Years of Life Lost

EXECUTIVE SUMMARY

Japanese encephalitis (JE) is emerging as a serious public health problem in Nepal. The diagnosis and treatment of the JE patient has financial consequences to the society. An economic study on JE was conducted in a small area in Kailali district. The main objectives of the study were to: determine the sources and levels of income of the typical JE HH; measure the direct and indirect costs incurred by HH to obtain preventive, diagnostic and curative services to JE; identify the socio-economic factors responsible for JE transmission and suggest policy recommendations for prevention, control and treatment of JE.

The study was based on primary as well as secondary sources. However, the study relied mainly on primary data. For primary data, 60 JE HHs, 30 male and 30 female, were randomly selected from the list ofJE patients from the hospital records. Pre-de signed, pre-tested questionnaires were administered, to collect quantitative information from the sampled HH. Focus group discussion with health personnel, JE patients, caretakers and key informants were also conducted to obtain in-depth information. Simple statistic al tools such as averages, standard deviations, correlations between variables to explain the nature of relationship and test of significance have been used. DALY calculation has been made using the formula outlined by Murray.

The study revealed that agriculture and wage earning were the main source of incomes of the JE HH, The average HH income was Rs. 48671. Within the sampled HHs, there was a wide variation in per capita income ranging from a maximum Rs. 22260 to a minimum of Rs. 2137 at current price. Using the poverty line income Rs. 4404 at constant price of 1996, the proportions of sample population under absolute poverty line was found to be 66.67 percent. Within the absolute poor HH, the per capita income range varied from Rs. 2137 to 5590 at current price.

A positive correlation (r =0 ,70) was found to exist between the HH size and the HH income. The Ginui Coefficient which measures the size distribution of income among the HH on the basis of per capita income was found to be 26.25 percent which is relatively lower than the national scenario (34 percent). Similarly, the Ginni Co-effecient among the absolute poor is relatively lower (15.49 percent) than that for sampled HH.

The direct cost which was the out of pocket cost of JE treatment involved medical cost, transportation cost, and food expenses. The medical cost was the largest component in the direct cost. The average medical cost of the sampled JE HH was Rs3831, The average transportation cost for JE HH was found to be Rs. 447. Food expenses which constituted the second largest components in the direct cost amounted to Rs. 1003 on an average. The average total direct cost was Rs. 5281 per patient. A positive relationship (r =» 0.24) between food expenses and per capita income was observed.

Indirect cost which refers to the time lost and consequently income loss by the JE patient and the caretakers in the economically active group (15-59 years) was calculated. This cost includes time lost after symptoms of JE before treatment started, time lost during treatment, time lost during recovery period, and restricted work days. Indirect cost in monetary term was calculated on the basis of the marginal productivity of labour which was equal to their prevailing market wage rate.

The average total time lost of the JE patient was 47 person days and the time lost by caretakers was 43 person days. The average total time loss of the HH (both patients and caretakers) was 90 person days. The female caretakers devoted more time in case of both male and female patients. The average monetary value of the time lost by the JE HH was found to be Rs. 5332,

The resource cost defined as sum of the direct cost and the indirect cost was the minimum resource cost as it did not include the cost of repayment of the loan borrowed and the opportunity lost due to disability ofJE patient. The direct cost component of the resource cost was almost equal to the indirect cost component with 49.87 and 50.13 percent, respectively. The average total resource cost to the JE HH was Rs. 10613 which was almost 15 percent of the average annual income of the JE HH. Of the total JE HH, 88 percent had borrowed loans for JE treatment and the maximum amount borrowed was Rs. 9000. The interest rate varied for different HH with the highest rate being 60 percent per annum. Due to the burden of interest payment, the resource cost is likely to increase further creating a downward poverty spiral or poverty trap such that non-poor becomes poor while the poor become hard core or marginal poor.

The correlations coefficients for variables showed that there was positive relationship between medical cost and patient time loss, disability index and patient time lost, household size and the household income etc.

DALYs which measure the years of healthy life lost due to a disease showed that DALYs lost for male patients (286.86) was larger than that for females (207.05). The total DALYs lost was 493.92. The DALYs would be still higher if the local health system had not provided the health services. The study estimated a DALY of 365.70 (70 percent out of total DALY lost) reduced as a result of treatment provided by local health system. However, the DALYs lost was still larger than the DALYs reduced through treatment by health system.

The study while analyzing the determinants of JE identified several risk factors. They were: environmental factors, occupational factors, level of income (poverty) factors, knowledge and behavioural factors and cultural factors. The study revealed that cases started to built up in the month of April-May and reached its peak during the month of August and September with more than eighty percent of the case incidence during July-September. The tropical climate with high

temperature, low altitude and rice field eco-system created favorable breeding environment for mosquitoes. The dependence on agriculture and wage earning that necessitated work in paddy field making them vulnerable to mosquito bite was the occupational factor identified as another risk factor. Living in poorly lit and poorly ventilated single storey thatched huts, sleeping outside in the open, poorly clothed children, open toilets, malnutrition and low resistance to disease were the outcomes of low income and poverty which served as a risk factor for JE incidence. The time loss in course of financial management such as seeking loans due to unavailability of cash in hand added to the risk of greater disability or death of patients, Lack of awareness about the transmission mechanism of JE and the treatment seeking practice in which the HH waited a few days for the patient to recover naturally before seeking treatment were the knowledge and behavioral factor causing greater incidence and burden to HH. The tradition of rearing pigs in the courtyard for celebration in the Maghi festival among Tharu ethnic communities served as a strong cultural factor.

It can be concluded that JE is a rural based disease and a disease of the poor. It imposes multi-dimensional impact such as economic burden on the HH, burden on the local health system, burden on society and increase in the marginal poor. JE had an impact not only on the income but on the sources of income as well which effected their future income flow and prospects of a better future. This aggravated the poverty situation in the society. Thus JE had serious impacts on the short run as well as the long run in the society. For the prevention of control of JE, programmes for awareness and behavioural changes, poverty alleviation, vaccination and surveillance, improving the capacity of LHS, coordination between government line agencies, use of natural measures of vector control has been suggested with programme implementation mechanism

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Chapter I
Introduction

1.1 Introduction

Japanese Encephalitis (JE) is a mosquito transmitted viral disease with over 50,000 cases and 10,000 deaths reported annually worldwide. This disease which was reported for the first time in Nepal in the 1970s has now spread to 19 districts and its coverage is increasing every year. Almost 85 percent of the total cases were reported from 8 districts connprising Kailali, Banke, Bardiya, Rupandehi, Parsa, Morang, Sunsari and Jhapa. during 1993-97. The highest incidence with 30 percent of the total oases was from Banke and 20 percent from Kailali district. Morang had 10 percent followed by Bardiya 7 percent. Thus almost 60 percent of the case incidence was in the three laterally adjoining districts of Banke, Bardiya and Kailali. The remaining 14 districts have case incidence 6.4 percent or less. Severe epidemics have occurred for the last several years with report of increasing morbidity cases and mortality deaths in spite of adopting strong collective efforts through the health care delivery system at different levels of services. The mean clinical attack rate is 1:300 per infected cases. Though the mortality is less than 10 percent in most outbreaks, patients who have improved clinically suffer from varying degrees of brain damage requiring life long care and considerable draining of society's resources (Bista and Shrestha, 2001).

1.2 Rationale and Importance of the Study

JE has become an emerging public health problem in Nepal. This problem attracts the attention of related authority. However, due to the lack of studies on socio-economic factors associated with IE transmission and health economics aspect of JE, there is a feeling of difficulty in the preparation of appropriate policies for prevention and control.

Health economics provides valuable tools and instrument for fUll utilization of the society's scarce resources. It avails policy makers with techniques how maximum benefits can be achieved with minimum resource use. It also provides us with alternative methods of prevention and control of diseases in a cost-effective manner. Unfortunately, however, the system of economic evaluation of health policies has not been adequately practiced in Nepal. Neither have health policies been developed on the basis of economic evaluation. For a country like Nepal with very limited resources at its disposal and growing health problems, there is a need for more researches in health economics to develop appropriate and cost effective policies of control and prevention of diseases. This study is an effort to contribute to policy making in case of one of the burning health issues of Nepal. In addition, the economic evaluation of clinical practice seeks to provide

structured information that can help decision makers choose among alternative methods of responding to medical conditions presented by the patients.

This is a inicroeconomic study. The cost of illness (COI) and disability .adjusted life years (DALYs) are two approaches used in this study. COI provides the minimum willingness to pay to get rid of disease in the JE patient which is equivalent to the existing market value for JE treatment. On the other hand, it provides a measure of economic burden on JE HH. The later approach DALY expresses years of life lost due to premature death and years lived with a disability of specified severity and duration. One DALY is a loss of one year of healthy life DALY is used to measure the respective burden of various diseases for the purpose of setting health priorities. It is also a measure of the effectiveness of health intervention. In this regards, the present study can serve as a baseline for future interventions. Both the approaches help in the designing of methodologies and encourage further health economic studies.

1.3 Objectives

The general objective of the study was to identify the socio-economic factors responsible for JE transmission in the endemic area and to measure the economic burden on the JE household due to morbidity and mortality

Specific objectives:

The specific objectives of the study were as follows:

1. To determine the sources and levels of income of the typical JE HH in the study area.
2. To measure the direct and indirect costs incurred by HH to obtain preventive, diagnostic and curative services to JE in the study district
3. To identify the socio-economic factors responsible for JE transmission
4. To sueigest policy recommendations for prevention, control and treatment of JE.

1.4 Scope and Assumptions of the Study

Due to time and financial constraints, the study was made more specific by making some assumptions These assumptions, however, do not narrow the validity and quality of the study These assumptions were:

i) In the case COI measurement, the study covered only morbidity cost and did not cover the cost of death of JE patients and sufferings, pains and uncertainty associated with this disease. Similarly, only short run cost was considered leaving out long run cost which

affect both the future economic activities of the HH and economic growth and development of the society in the long run.

ii) In considering indirect cost of JE, the opportunity cost to the employers due to absentee workers was not taken into account.

iii) It was assumed that employment was available to all working age population willing to work in some productive activity be it herding cattle, working on private lands, wage earning or small scale business activities. This was necessary on account ofmeasuring the indirect cost of work days lost by JE patient and caretaker in the working age group. The opportunity cost of time lost is expressed in terms of the marginal productivity of labour which is the prevailing market wage rate for the skilled and unskilled workers.

iv) In the estimation of DALYs, only three types of cases were considered. They were DALYs lost due to immediate death, DALYs lost due to permanent disability and DALYs lost due to disability followed by complete recovery. It was assumed that the patients with disability at the time of field visits were permanently disabled.

1.5 Some Literature on JE

JE is primarily a zoonotic disease infecting mainly vertebrate animals, e.g. pigs, birds, horses. Man is involved in transmission cycle as an incidental and dead end host and plays no role in perpetuating the virus (Bista and Shrestha, 2001). It is a disease of the rural agricultural areas where vector mosquitoes live and grow in close association with the main vertebrate hosts: pigs, wading birds and ducks incriminated as important vertebrate amplifying hosts for JE virus. Mosquitoes infect domestic pigs and water birds with JE virus. JE virus is amplified in the blood system of domestic pigs and water birds. Infected mosquitoes then transmit the JE virus to humans and animals during the feeding process. The clinical attack rate is low (approximately I: 20 - 1; 1000) infections with mean rate of 1:300 infections. (Kalyanarooj, 1995).

Entomological studies carried out during JE outbreaks of 1981-84 have shown *clilicine* mosquitoes namely *Cx tritaeniorhyncus, Cx gelidus, Cx vishni, Cx pseudovishnii,* and *Cx fuscocephala* as suspected vectors. As *Cx trifaemorhyncus* is abundantly found in rice-field ecosystem of the endemic areas during the transmission season and JE virus isolated have been obtained only from a pool of *Cx tritaeniorhyncus* females, this species is suspected to be the principal vector ofJE in Nepal (Gubler et.al 1989, Darsie et.al. 1989). *Culicine* mosquitoes breed in irrigated rice fields, shallow marshes, ponds, pools and ditches with fresh or polluted water with grass or aquatic vegetation in partial shade or full sun. Breeding preference of *Cx tnfaemorhyncus* and epidemics of JE associated with paddy field ecosystem have been adequately substantiated by different studies. *Culex* mosquitoes prefer to feed outdoor principally

on vertebrate hosts other than man. They feed predominantly on cattle, pigs and human. Humans, as mentioned earlier are the incidental hosts. The important factor governing spillover oft he disease to man are the related abundance of the vectors, the availability of amplifying hosts, the density and absolute number of mosquitoes, adequate man mosquito contact and longevity of vector. Some studies show settlement crowding, religion, ethnicity, exposure to domestic animals and lane of air conditioning and mosquito nets as some of the risk factors associated with acquisition ofJE infection (Chaudhari, et.al. 1992).

Mild infections occur without apparent symptoms other than fever with headache. More severe infection is marked by quick onset, headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, occasional convulsions (in infants) and spastic paralysis. Incubation period is usually 5 to 14 days The illness resolves in 5-7 days if there is no CNS involvement.

In Nepal, cases generally start to build up in the month of April-may, and reaches its peak during the months of August and September. JE cases start to decline by the end of September and the beginning of October, to level off in the month of November. Ninety percent of the total cases of JE are concentrated in the period ranging from June to October, coinciding with the rainy season

1.6 Outline of the Study

There are four chapters in the study report. The first chapter deals with the introduction, rationale and importance, objectives, scope and assumptions of the study and some literature on JE. The second chapter covers conceptual framework and methodology used in the study. Introduction of the study area, findings and analysis of results are dealt in the third chapter. The last chapter concentrates on conclusions and recommendations for policy interventions.

Chapter II

Methodology of the Study

2.1 Conceptual Framework

Good health is one of man's precious assets (CMDR, 1996, P. 21). So it is typically an economic sector like industry and agriculture. Good health of the population significantly contributes to human capital development and economic productivity. Thus., the benefits of good health of the population are clear - a healthy and productive work force which will assist in economic growth and thus poverty alleviation in the country as a whole. On the other hand, the cost of the serious illness is a major generator of poverty (Hsia, 2000 P. 6) and impedes economic growth and long run development.

There may be two approaches to estimate the economic cost of JE - short run and log run. Short run cost include cost associated with taking action to treat the illness, productivity losses through lost time and in case of death, loss of future earning, economic cost of the pain and suffering and uncertainty associated with the disease etc. These short run costs impede economic growth and long run development in many ways. Short run cost has played a significant role in the poor economic performance in related communities. So the economic studies may be concentrated on short run cost burden and long run cost burden on the HH and the society or the nation as a whole.

Conceptually, the following methodology is adopted to assess the cost due to morbidity and mortality and the inter-Hnkages between economic activities and health status. This study concentrated only on the short run cost on the JE HH, The short run cost of IE can be broadly broken down into two categories: direct and indirect economic cost.

- ***Direct economic costs to HH "*** These reflect financial expenses incurred by HH. This cost covers all the costs incurred by the JE HH from the inception of the symptom of the disease to complete recovery. Thus the direct costs to HH may simply boil down to medical costs, meals at health facility, transportation cost etc with consideration to avoid the possibility of double counting, particularly in case of food expenses.
- ***Annual Income of the HH -*** It refers to the income earned collectively by all members of the HH in one income cycle from Nepalese calendar 2058 (mid-April 2001- mid April 2002). It includes income from agriculture, wage work, small enterprise etc. The annual income of the HH serves as a reference and a crosscheck to the direct economic cost of treatment. The JE

sickness may extend across one income cycle, but -the cost of JE treatment may be met through past saving, current income or through borrowing. The direct cost of JE treatment is compared in terms of one income cycle only.

- ***Indirect economic casts to HH -*** These reflect opportunity cost associated with JE. This is the income lost due to inability to work by the JE patient and the caretakers while getting diagnosed, receiving treatment and during recovery. The caretakers who accompanied the JE patient for treatment includes the spouses, parents and relatives. The opportunity cost of work days lost was measured in terms of the marginal productivity of labor expressed in terms of prevailing market wage rate. The patient attending work but working less than normal capacity and time is considered as restricted work days. The indirect cost is calculated on the basis of total work days lost and restricted work days.
- ***DALYs measurement -***Disability adjusted life years are the sum of years of life lost (YLLs) and years of life lived with disability (YLLDs). DALYs are therefore a measure of something lost' rather than something 'gained"; DALYs are not desired themselves, but rather what is sought is their reduction (Fox-Rushby and Hanson, 2001). One DALY is thus one lost year of healthy life. Disease burden is, in effect, the gap between a population's actual health status and some "ideal", or reference status. In order to measure burden, a society has to decide what the ideal or reference status should be.

  Taking into account that each health problem results in four possible outcomes (death, disability before death, permanent disability, or fUll recovery), DALYs lost for each one of the above four possible outcomes can be calculated. The intended use of the DALY is to assist (i) in setting health services priorities; (ii) in setting health research priorities; (iii) in identifying disadvantaged groups and targeting of health interventions; and (iv) in providing a comparable measure of output for intervention, program and sector evaluation and planning (Murray, 1994).

2.2 Methodology Applied

2.2.1 The Project Design

The goal of this study was to determine the socio-economic factors responsible for JE transmission and to evaluate the direct and indirect economic effects on HH. Kailali, which was one of the two most JE affected districts of Nepal was purposely selected for this purpose. The research was exploratory and used a descriptive-analytical framework.

2.2.2 Sources of Data

To fulfill the objectives of this study, primary as well as secondary cross-sectional data of one year was collected. Secondary data was collected from different sources such. as articles, reports, Central Bureau of Statistics, Nepal Health Research Council, Ministry of Healthy hospital records etc. The study has relied mainly on primary sources.

2.2.3 Collection of Primary Data and Sampling Method

The study was based mainly on primary data collected at HH level. The Information collected through structured questionnaire in Nepalese language from 60 HH, 30 male and 30 female, selected at random from the list of patients, clinically proven to have caught JE, who had been discharged from the government hospitals in the area after treatment or died in course of treatment. Researchers were provided with training before conducting field surveys. To facilitate better communication with respondents, local field assistants, who were also involved in local health system were trained and employed in the collection of information. The information from JB HH were collected by researchers under the direct supervision of the Chief Investigator and Co-expert.

A household was defined as all persons who lived under the same roof and shared a common kitchen for at least six months of a year. From the list of the patients admitted in the hospital for JE treatment during Baisakh 2058 to Baisakh 2059 (mid April, 2001 to mid April 2002) which is one year period of Nepalese calendar. Seven areas (municipality and VDC) namely, Sandhepani, Pahalmanpur, Masuriya,Chaumala, Geta, Malakheti and Dhangadhi with more than ten JE HH were purposively selected in the study area. The reason for considering only those areas with more than ten JE patients was due to the low probability of finding the JE patient and the caretaker because the name of the patient, age, address etc. were not very exact and accurate and there was no system of recording the name of the parents in the hospital record if the patient was a child. The total number of JE HH obtained from the hospital record was grouped into two categories: male and female. Thirty households in each category were randomly selected from the list of the purposively selected seven areas Information was collected from the JE HH on their HH income dynamics, the direct cost and indirect cost of JE treatment, The direct cost comprised of medical expenses, transportation cost, food expenses and recovery cost of the patient and the caretaker. Similarly, the indirect cost comprised of the opportunity cost of the time lost of the patient, caretaker and other HH members in course of treatment of JE, and restricted work days. Necessary information for the measurement of DALY such as immediate death, permanent disability followed by complete recovery, age, onset year etc was collected through structured questionnaire.

$$YLLs[r,K,\beta]=\frac{Kce^{ra}}{(r+\beta)}\left\{e^{-(r+\beta)(L+a)}[-(r+\beta)L+a)-1]-e^{-(r+\beta)a}[-r+\beta)a-1\right]\}+\frac{1-K(1-e^{-rl})}{r}$$

Where, K = age weighing modulation factor, c = constant) r = discount rate; a= age at death, 13 = parameter from the age weighing function; L = standard expectation of life at age a.

$$YLLs[r,K,\beta]=D[\frac{Kce^{ra}}{(r+\beta)}\left\{e^{-(r+\beta)(L+a)}[-(r+\beta)L+a)-1]-e^{-(r+\beta)a}[-r+\beta)a-1\right]\}+\frac{1-K(1-e^{-rl})}{r}]$$

Where, K = wage weighing modulation factor; c = constant , *r* = discount rate; a ~ age of onset of disability, 3 = parameter from the age weighing function, L = duration of disability, D == disability weight.

The value of the parameters recommended by Murray and Lopez (1996 a,b) are r = 0.03; K = I, p = 0.04, C = 0.1658 For calculation of the YLLs and YLDs, local life expectancy of Kailali used was 51 and 53 years for female and male respectively. The disability weights used as recommended by Murrav(1994) are as given in the table below:

Index of Disability

Cases	Description	Weight
Case I	1. Limited ability to perform at least one activity in one of the following areas: recreation, education, procreation or occupation	0.096
Case II	2. Limited ability to perform most activities in one of the following areas: recreation, education, procreation or occupation	0.220
Case III	3. Limited ability to perform in two or more of the following areas: recreation, education, procreation or occupation	0.400
Case IV	4. Limited ability to perform most activities in all of the following areas: recreation, education, procreation or occupation	0.600
Case V	5. Needs assistance with instrumental activities of daily living such as meal preparation, shopping or housework	0.810

Case VI	6. Need assistance with activities of daily living such as eating, personal hygiene or toilet use	0.920

Disability lies between 0 to I (i.e. perfect health = 0 and death =l)

To find out the poverty-line income, Rs. 4404.00 per capita per year at 1996 price, which was used to estimate below poverty-line population in the Ninth Plan document in Nepal was used in this study. The collected nominal income figures were converted into 1996 constant price by the GDP deflator which may be a good proxy for the overall price index. Ginai Coeffecient is used to measure the distribution of income among the total sampled HH and among the below poverty line HH. The following formula was used for calculation of Ginni Coefficient Sen, 1974) .

$G=1+1 -2=(y_1+2y2+3y3+\ldots\ldots\ldots\ldots\ldots+nyn)$

Where, G = Ginni Coeffecient
N = number of observations
y> "individual mconie.
y = average income

Chapter III
Findings and Analysis

3.1 Introduction of the Study Area

Location

The study was conducted in Kailali which is one of the seventy five districts of Nepal. Kailali district lies in the western Terai region of Nepal It borders with India in the south, Doti, Dadheldhura and Si-irkhet districts in the north, Kanchanpur and Dadheldhura in the west and Karnali river, Bardiya and Surkhet in the east. There are 42 VDCs (7 hilly VDCs and 35 Terai VDCs) and two municipalities, Dhangadhi and Tikapur in the district. This district lies in the tropical climatic zone at a low altitude, a few hundred feet above sea level. The average annual rainfall is 1840 mm with temperatures maximum of 43 degree Celsius in summer and minimum 5 degree Celsius in winter. The lowland plain which constitutes almost 60 percent of the district was previously inhabited only by a few ethnic communities which were believed to be resistant to malaria. After malaria control programs in the 1950s, people from the hills and mountains in large number started to migrate to these plains. Due to the open border with India, people can move across the border and there is free mobility of labour and capital across the two countries.

Demographic and Socio-economic Situation of Kailali District

The district is home to some 6,20,035 population of which 50.4 percent are male and 49.6 percent are female. The annual population growth rate of 3.93 was rather high compared to the national average of 2.3 percent (census2001). The average family size was 6.84. The ethnic composition of the population was dominated by Tharu population of 49.52 percent followed by Chhetri 14.48 percent. Brahmin 9.58 percent etc. The occupational casts such as blacksmith and the tailor consists of 9.16 and 2.95 percent respectively The literacy rate of the district was48 percent (male 64 percent and female 36 percent) with wide variation among different ethnic communities. The primary school enrollment rate is only 70.2 percent with boys 80.9 percent and girls 53.5 percent. Worse still was the school drop out rate of 27.5 percent at the primary level.
51 percent of the total population is economically active with low economic activity rate among females (male 687 percent and female 31.3 percent). Agriculture was the dominant occupation with 79.8 percent population depending on agriculture as the main source of livelihood while non agricultural activities constituted 20.2 percent only. The average per capita income of the district was Rs. 6824.00 which *was* far below the national figure of Rs. 18083. About 36 percent of the

total families owned less than half Bigha land while 2483 families were landless. The food situation for the study area is given below.

Percentage of HH with Food self sufficiency for Study Areas

Area	≤ 3 months	3-6months	6-9months	9-12months	<12months	≥12months
Dhangadhi	21.1	3.1	11.6	8.3	44.1	55.9
Pahalmanpur	5.4	0.0	2.7	1.4	9.5	90.5
Sandhepani	8.5	5.4	14.9	6.8	35.6	69.4
Chaumala	2.9	5.8	14.1	13.1	35.9	64.1
Geta	14.4	4.9	15.9	8.9	44.1	56.9
Masuriya	2.0	7.3	8.7	8.0	26.0	74.0
Malakheti	6.5	1.9	5.7	5.0	19.1	80.9
Kailali District	7.1	3.9	10.6	6.2	27.8	72.2

Source: Office of District Development Committee, Kailali.

The Health Situation of Kailali District

The average life expectancy of the people ofKailali was 53 years. This figure was 53 years for male and 51 years for female (NSAC, 1998). The infant mortality rate was 61.5 and child mortality rate was 102 per thousand. The percentage of mothers receiving hospital services during deliveries is only 13 percent and consequently the maternal mortality rate was 539 per one hundred thousand live births . Only 10.31 percent of the total population had access to piped drinking water. The percentage of houses using latrines was 37.47. There were two govemmeni hospitals in the district: Seti Zonal Hospital, Dhangadhi (50 beds capacity) and Geta Eye hospital, Oeta (150 beds). In addition, there were 5 Primary health centres, 8 health posts, 30 sub-health posts. On the basis of the number of cases registered in the hospital, the ten major disease categories were skin diseases, PUO, Diarrhea, ARI, intestinal worms, gastritis, ear infection, pain. COPD and eye complaint. Though many diseases did not appear as significant ones in terms *o* the total number of cases in a year, vector born diseases such as malaria and JE emerged as acute health problems during the four monsoon months starting from June to September and claim live' of large number of people within a short duration. In the year 2001, for instance, of the 401 JE patients admitted in Seti Zonal hospital 43 percent had died (Case fatality rate 10.7 percent) ir course of treatment while 4 had been referred to advanced health institutions in view of th(severity of the cases.

3.2 Demographic and Employment Characteristics of Sampled HH

The total population of the sampled HH was 531 with a male female (M/F) ratio of 1.07 which was found to be larger than the figure for the district level (1,03) The HH size of the sampled population was found to be 8.85 which was larger than the HH size for the district level (6.53). The literacy rate for the sampled HH was 39.17 which was smaller than the district level figure (48 percent). The economic ally active population was 52.73 percent which was slightly higher than the district level figure (50.1 percent). The major occupations of the sampled HH were agriculture and wage earning with participation of both adult male and female. In the study, the population below the age of 15 were considered as children and were accounted as economically active population In agriculture and wage earning, there was employment opportunity throughout the year to workers willing to work at existing wage rate. There were greater employment opportunities during agricultural activities of paddy cultivation which was also the peak time for JE incidence.

3.3 Sources and Levels of Income

The sources of income of the sample households is categorized as follows

Agriculture and Wage Earning

Wage earning and agriculture was the largest source of income of the majority (24 HH i.e. 40 percent) of the households. The households which depended on agriculture as well as wage earning were those who did not have enough land to engage all the working age members of the HH in their own land throughout the year. The family members of such HH worked as seasonal labourers mostly in agriculture.

Agriculture

Agriculture was the second largest single source of income of sampled HH. Of the sampled 60 HH, 18 HH (30 percent) depended upon agriculture alone and paddy was the most important crop of those HHs . These category of the sampled HH relied on agriculture either because they had adequate land to engage all the working age members in agric ulture or the households did not have a tradition or working for wages.

Wage Earning

16 households (26.67 percent) had wage earning as the only source of income. These HH did not own any agricultural land. Most of the HHs in this category were migrants and homeless making

a living through wage earning.

Business

Very small percentage of the sampled HHs (2 HH i.e. 3.33 percent) depended upon business These business were in fact petty business such as retail shop or repair and maintenance shop. One very note worthy fact was that whether they worked in agriculture or wage labour, the main source of income of the HH was physical work. Thus physical health was the main source of income. Thus good physical health was vital for many of the HHs to generate income and was a factor that determined stability of HH income. In that sense, poor health was a major risk factor reducing HH income.

Levels of Income

Due to lack of diversity in economic activities, limited employment opportunity, low wage rates and low productivity, sampled HH incomes were low. The average annual HH income of the sampled HH was found to be Rs. 48671. Within the sampled HHs, there was a wide variation in per capita income ranging from a maximum Rs. 22260 to a minimum of Rs. 2137 at current price, The coefficient of range was obtained to be 0.82. By using the poverty line income Rs. 4404 at constant price of 1996 (Rs. 5759 at current price), the proportions of sample population under absolute poverty line income was determined. The absolute poverty index among the sampled HH was found to be 66.67 percent, an outcome almost double than the national scenario (38 per cent). Within the absolute poor HH, the per capita income range varied from Rs. 2137 to 5590 at current price.

A positive correlation was found to exist between the HH size and the HH income. This correlation coefficient was r "0 .70, which was also satisfied by probable error test. It means that the HH income is a function of the HH size. There is a rise in HH income with a increase in the HH size. This finding suggests that size distribution of income should be measured on the basis of the per capita income rather than the HH income. The Oinni Coefficient which measures the size distribution of income among the HH on the basis of per capita income was found to be 26.25 percent which is relatively lower than the national scenario (34 percent). Similarly, the Ginni Coefficient among the absolute poor is relatively lower (15.49 percent) than that for sampled HH.

3.4 Direct cost to JE HH

The direct cost to JB HH involves medical cost, transportation cost, and food expenses There is no specific treatment for IE (see appendix C). Supportive and symptomatic treatment is adopted with meticulous nursing care (critical care medicine). For this purpose some medicines are provided by government hospital free of cost and the rest the patient should purchase from the market Since the resources of the government hospitals are limited, the medicines cannot be provided free of cost to the patients. This is particularly the case when hospitals are overburdened with patients (not only JE). The most widely used expenditure items in JE treatment are Ryle's tube, catheter, IV drip and antibiotics to prevent secondary infection in some cases. Thus, the medical costs were cost involved directly in the process of treatment such as registration fee, cost of drugs, cost of pathological tests, IV-set necessary during treatment etc.

Transportation cost include cost of round trip of transportation for the patient and caretakers in course of obtaining diagnosis and treatment. The cost incurred in course of provision of meal to the patient and the care-taker to the hospital are also included.

Food expenses involved cost of food items purchased and the cost of preparing it such as rice, vegetable, cooking oil, kerosene etc. It also involved cost of fruits, milk, tea and snacks for the patient and the caretaker. To avoid the problem of double counting, items like food grains, milk, vegetables, cooking oil etc which they brought from home were not included in food expenses Only those food items acquired through cash payments during stay in the hospital were included in food expenses. If the caretaker is not a family member, the food cost for that person, during the patient's hospitalization is a net cost to the patient's HH. Other cost involved cost of items purchased for recovery of the patient like fruit, milk, meat, and vitamin supplements etc.

The medical cost was the largest component in the direct cost. The average medical cost of the sampled JE HH was found to be Rs3831 (Table No. 1). The average medical cost was Rs. 3550 for male patient and Rs. 4112 for female patients. The average medical cost seems slightly higher for female patient compared to male patient. However, there is no significant difference between means of male and female at 5 percent level of significance (Table No. 2).

The average transportation cost for JE HH was found to be Rs. 447 (Table No.). This cost was almost similar for both male (Rs. 430) and female (Rs. 464). The Z-test reveals that there is no significant difference between means of male and female at 5 percent level of significance (Table No. 2).

Food expenses constitute the second largest components in the direct cost. The average food expenses incurred by the JB HH was found to be Rs. 1003. Food expenses were different for male (757) and female patients (Rs. 1250). The Z-test reveals that there is significant difference

between means of male and female at 5 percent level of significance (Table No. 2). This is because the number of caretakers were larger for female patients compared to male patients. Food costs refer to cost of meal for the patient and the caretaker which was purchased from the market during their stay at the hospital. Food cost also included milk, fruits etc. An interesting positive relationship ($r = 0.24$) between food expenses and per capita income was observed. The interpretation of this relationship is that HHs with higher incomes afforded more expenses on food items compared to lower income HHs. This correlation is justified when the correlation is compared with its probable error (Table No. 6). The components of direct cost for male and female is shown in the pie chart.

3.5 Indirect Cost to JE HH

Indirect Cost: **Time Lost by Patient and Caretakers**

Indirect cost refers to the time lost and consequently income loss by the JE patient and the caretakers in the economically active age group (15-59 years). The time lost in case of economically inactive patients refers to time lost by caretakers only. The time loss includes time lost after symptoms of JE (see appendix B) before treatment started, time lost during treatment, time lost during recovery period (with no symptoms ofJE thereafter but only with some impact in the form of some permanent disability or complete recovery) and restricted work days. The time lost of both the patient and the caretaker are taken into account. Indirect cost in monetary term is calculated on the basis of the marginal productivity of labour which is equal to their prevailing market wage rate.

The average total time lost of the JE patient was found to be 47 person days. The average time lost was greater for female patient (53 person days) compared to male patient (41 days).The average time lost by caretakers was 43 person days (Table No. 3) with 36 person days for male patients and 50 person days for female patients on an average. The average total time loss of the HH (both patients and caretakers) was 90 person days with 77 person days for male patients and 102 person days for female patients. The Z-test results reveal that there is no significant difference between male and female category patients though some difference exists in average figures for the two categories. In the case of male and female caretakers category, the result showed that female devoted more time as caretakers (person days 24) compared to male caretakers (19 person days). The female caretakers devoted more time in case of both male and female patients. The general practice of female caretaker giving continuous care to the patients at hospital and male caretakers making occasional visits for provision of drugs and other supplies create this difference.

Indirect Cost: Monetary Value of Time Lost

The average indirect cost of JE to the HH for was found to be Rs. 5332.

Among the different patient categories, the average indirect cost was found higher in case of female patients *(R&.* 6304) compared to male patients (Rs. 4360) The reason behind the higher average indirect cost was the high time lost in case of female patients mentioned earlier. The difference in the monetary value of the time lost between male and female caretaker is lower than the relative difference in the time lost due to the lower wage rates in case of female patients

3.6 Resource Cost

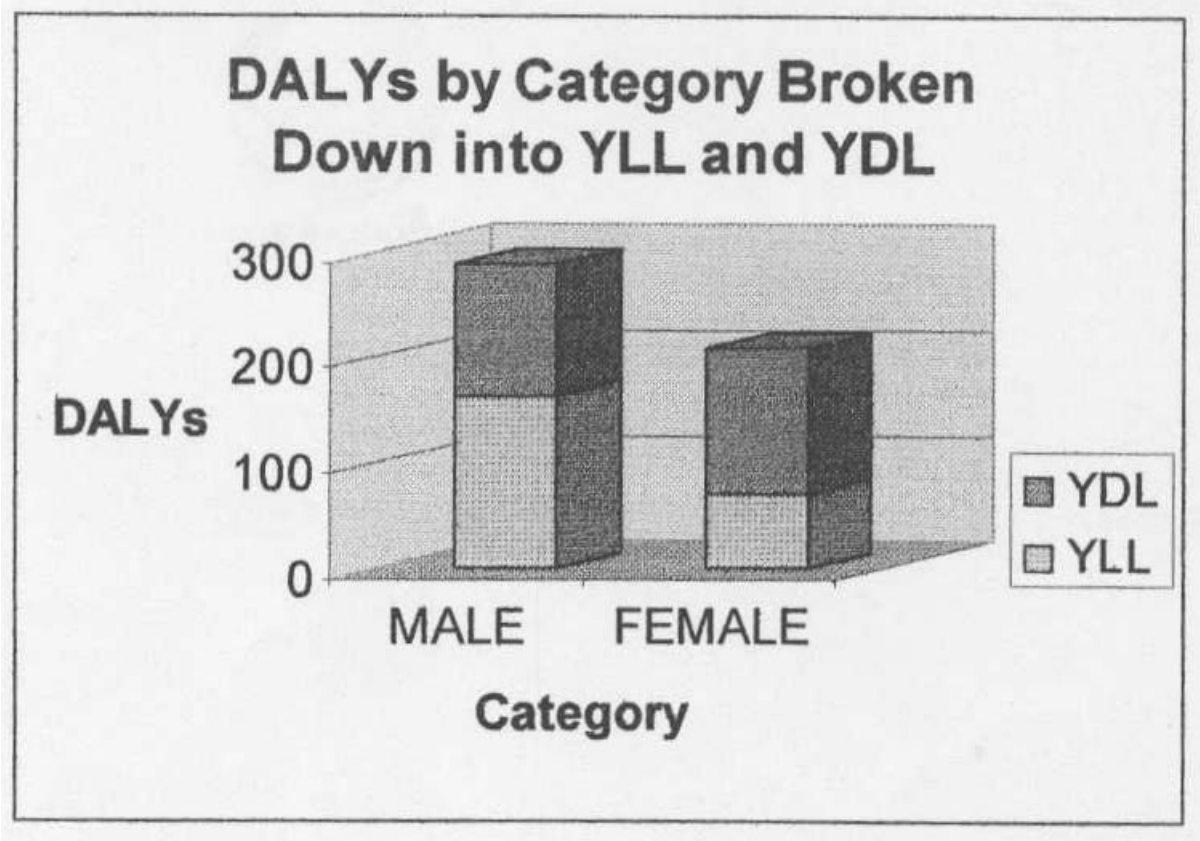
The resource cost has been defined to include the direct cost and the indirect cost borne by the HH in course of the JE treatment. There is a possibility of increase in the direct cost due to repayment of the loan borrowed at some future date and increase in the indirect cost due to the opportunity lost due to disability. However, both these components are difficult to estimate. Thus the resource cost calculated in the study implies the minimum resource cost of the JE HH The components of the direct and the indirect cost have been dealt earlier. In the resource cost, the direct cost component is almost equal to the indirect cost component with 49.87 and 50. 13 percent, respectively. The average total resource cost to the JE HH was Rs. 10613 which was almost 15 percent of the average annual income of the JE HH. This cost was also different for male and female category with average cost of male Rs. 9095 and female Rs. 12130. The rationale behind the difference in the resource cost for the male and the female category is due to the difference in the direct and indirect cost as already dealt above. Of the total JE HH, 88 percent have borrowed loans for JE treatment and the maximum amount borrowed *is* Rs. 9000. More than 90 percent of the absolute poor HH were found to have borrowed loans. The interest rate varied for different HH with the highest rate being 60 percent per annum. Due to the burden of interest payment, the resource cost is likely to increase further to the indebted JE HHs. The duration of repayment is likely to be higher for the poor compared to the non poor which will heighten the interest payment leading to greater resource cost. Such higher resource cost may create downward poverty spiral or poverty trap such that non-poor becomes poor while the poor become hard core or marginal poor.

3. 7 Analysis of Correlation between variables

The correlations coefficients for some variables were computed and probable error test were performed (Table 11). There is positive relationship between medical cost and patient time loss ($r = 0.27$). The result shows medical cost have increased with inpatient days in the hospital and work days lost before and after hospitalization. Similar relation was found to exist between food expenses and per capita income. HH with higher per capita income provide diet supplement in addition to basic food to the patient. The disability index and patient time lost were also found to have positive relation. The patients with greater morbidity days in course of hospitalization and before and after hospitalization were found to incur greater disability. The household size and the household income was also positively related which has been dealt earlier too. The HH which incurred larger out of pocket cost (direct cost) in the treatment of patient were found to have borrowed larger amount as loans.

3.8 DALY Measurement

DALY measures the loss of life years on the basis of life expectancy due to premature death and disability. As a fatal disease JE may cause immediate death or it may inflict disability to the patient for different duration. Immediate treatment of JE may lead to recovery. Higher the DALY figure for a patient, higher is the burden of the disease on the society. The objective of the local health system is to reduce the DALYs through treatment of the JE patient. DALYs are the sum of two components : years or life lost (YLLs) and years of life lived with disability (YLDs). In the case of the sampled HH, the DALYs lost for male (286.86) was found to be larger than that for females (207.05) The total DALYs lost was 493.92. The DALYs would be still higher if the local health system had not provided the health services. The treatment of the JE patients by the local health system reduced a DALY of 365.70 A comparision would reveal that the DALYs lost is still larger than the DALYs reduced through treatment by health system. A measurement of DALYs helps in the cost effectiveness analysis of the local health system. It reveals low effectiveness of LHS in the treatment of JE. The components of DALYs is shown in the following diagram.



According to the hospital discharge record ofSeti Zonal hospital, Dhangadhi, of the total 401 JE patients, 43 persons had died among which 63 percent are male while 37 percent are females. Among the sampled HH too, the number of death was higher for male patients (7)than the female patients (3). As a result, the YLLs of male was higher than the YLLs of the female. In case of YDL, the figures are higher for females compared to males. Higher the disability, higher is the patient time loss. There was a slightly higher disability among female patients. The patient time loss was also found to be slightly higher for female patients.

3.9 Deterniinaiits of JE Transmission

The general symptoms of JE are fever, rigor, headache, general malaise, nausea and vomiting (see appendix B). The incidence of JE was observed mainly during the months of Juneto October, reaching its peak during August as shown in the graph below.

Though there are occasional incidence of JE during other months, the highest risk period for JE is August and September. "Once there are sunny days after a few days of heavy rainfall during mid-September to mid-October, we prepare ourselves for the possible inflow of a large number of patients in the hospital seeking treatment for JE", said the Medical Superintendent of Seti Zonal Hospital.

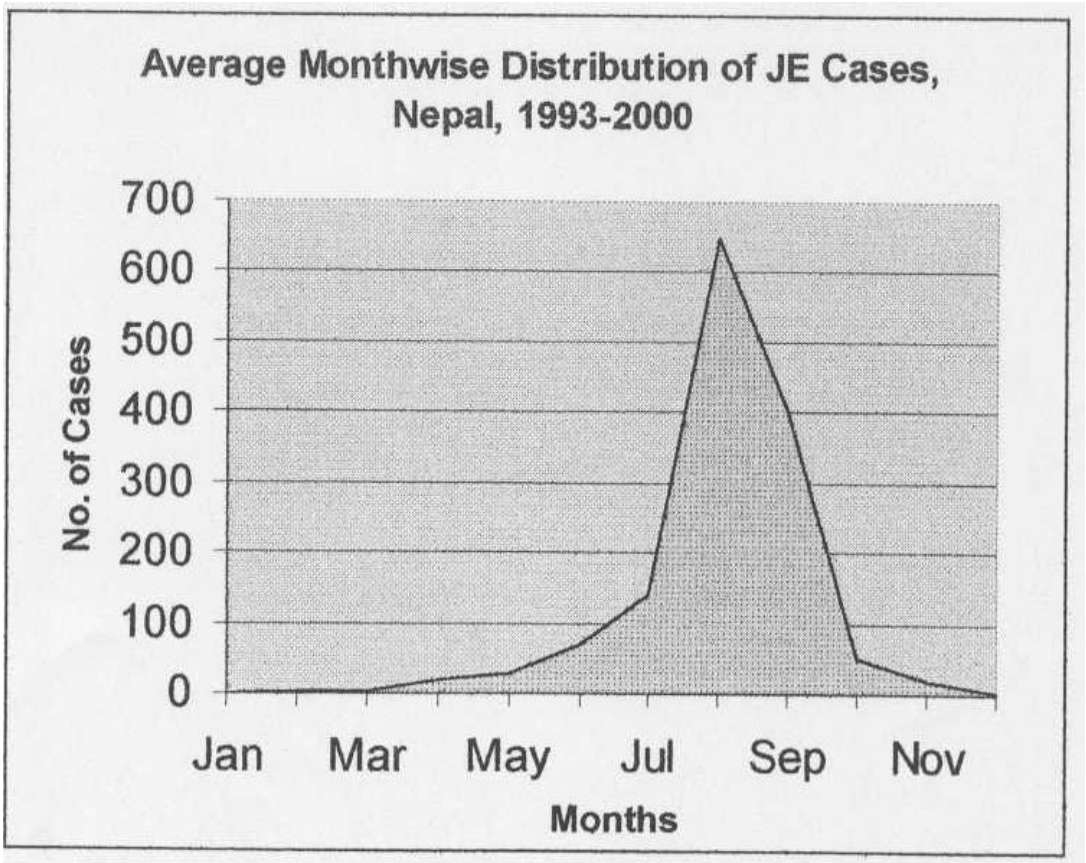


Fig: Reported Cases of JE by Months, Nepal

Cases of JE are reported throughout the year every year. Epidemics occur during the rainy season. The above figure reveals that cases started, to built up in the month of April-May and reached its peak during the month of August and September. Cases start to decline by the end of September and the beginning of October, to level off in the month of November. More than eighty percent of the case incidence was during July-September.

The Analysis of the determinants of JE transmission is based on the information collected through focus group discussion with health personnel, JE patients, caretakers and key informants of the endemic area and structured questionnaire administrated at JB HH. The following risk factor of JE has been discussed as follows

Environmental Factor

The study area lies in a tropical climatic zone with a temperature varying from 24 to 43 degree Celsius during summer It is very hot and humid, it is also a low lying area with an altitude of 109 metres above sea level and a little above it. As a low land, the study area was poor in natural drainage system with water logging in the form of ponds, ditches etc. during monsoon. As a part of the Gangetic plains, most of the land area is brought under paddy cultivation during monsoon creating an paddy field ecosystem favorable for breeding of mosquitoes. The temperature and the aquatic condition increase the activities of the mosquitoes during this season.

Occupational Factor

The majority of the JE HH depended on agriculture or wage earning for livelihood. Their occupations required the HH members to work in the paddy fields from early mornings to evenings rendering exposure to mosquito bites unavoidable.

Low level of in come (or Absolute poverty)

The positive relation between low income and poor health is well established (Lynch et al 1997) The poor are already vulnerable in terms of the housing condition. Most of the infected HH were found to live in thatched singled storey houses with poor ventilation. Thus most of the adult males slept in the open during the hot summer. Due to low level of income and consequently deficiency in calorie and other nutrient intake, the poor HH members suffer from malnutrition and are less resistant to JE. More than 90 percent of the JE HH have no toilets and the HH members defecate

in the open adding to the risk of being JE infected because mosquitoes particularly feed on its host during the early mornings and evenings Another factor that raises JE incidence was that most of children in JE HH did not cloth the children. Particularly, the children played around naked or almost naked during summer. Further, when the HH member fall sick with JE, due to the lack of cash in hand with the HH and for lack of health insurance facility, low income HH have to incur significant time loss in course of financial management such as seeking loans etc. This delay in seeking health services results in worsened condition of the patients, consequent higher future disability and even death

Knowledge and Behavioural Factors

Most of the respondents were found to have heard about JE Most of them considered that JE is caused by mosquito bite. However most of them are unaware about the transmission mechanism ofJE in which pigs and water birds act as amplifying agent for JE virus, (see appendix E)
The JE HH reported that they waited a few days for the patient to recover naturally expecting that the patient was suffering from some simple disorders. They started seeking health services once the condition of the patient started to deteriorate. This caused the worsening of the condition of the patient causing longer days for recovery, greater treatment *cost,* life long disability or even death of patient.

Rural Based Disease

JE was basically a disease that spread in the rural areas where health services were relatively inaccessible and dwellings had a rural characteristics with paddy fields, livestock such as cattle pigs, ducks etc as an integral part of living. Even within the areas designated as urban, JE was more common in the outskirts of such urban areas which had less access to health facility and possessed common features of the rural areas.

Cultural factors

According to the medical personnel, about three fourth of the JE patients come from the Tharu community. The Tharu community and some other ethnic groups have a long tradition and cultural practice of raising pigs in their courtyards for the Maghi festival that falls on February. The community people start rearing pigs for this purpose from July-August. The pigs reared in the open courtyard near living and working places, playing spaces of children etc. without any scientific management thus serve as the main amplifying host for JE virus during the peak JE transmission during September-October.

3.10 Discussion

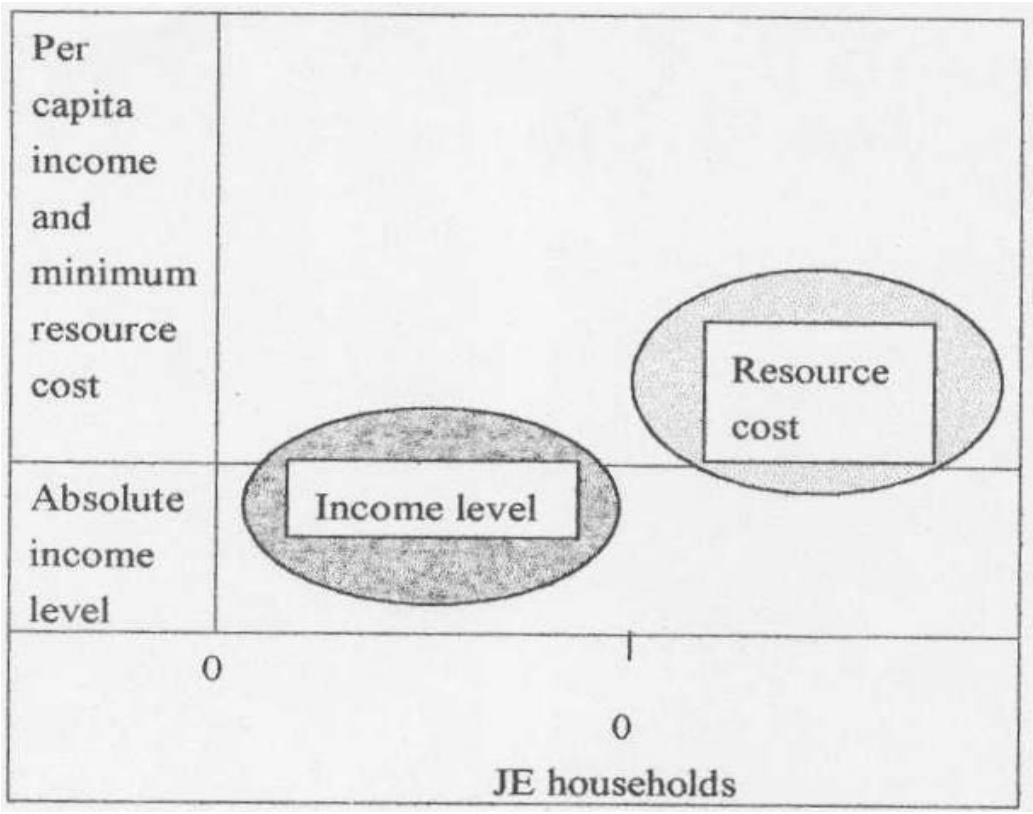
IE has emerged as a serious public health problem. This is substantiated by the fact that of the 401 JE patients admitted in Seti Zonal hospital for treatment *in* the year 2058, II percent died in course of treatment and 62 percent of the JE patients had lifelong disability of some kind (according to field survey). Only one out of four patient who had undergone JE treatment gained complete recovery. The rice-field ecosystem of the Terai belt is very favourable for the breeding of culex mosquitoes, the proven vector of JE in Nepal. Almost 50 percent of the total population live in the Terai in Nepal. Though JE has appeared only in 19 districts at present, its coverage is increasing each year (Bista et.al. ,2001).

The study area was favourable for breeding of culex mosquitoes and JE transmission. The temperature, altitude and the aquatic condition created by paddy Field ecosystem increase the activities of the mosquitoes during JE transmission period. The majority of the inhabits of the study area are dependent on agriculture and wage earning making exposure to mosquito bite unavoidable. People live in thatched single storey huts with poor ventilation and lighting. For this reason people stay most of the time outside during evenings Due to lack of toilets, people defecate in open adding to the risk of being JE infected because mosquitoes particularly feed on its host during the early mornings and evenings. Small children play naked in the open during summer. Maghi was a most jubilantly celebrated festival of the Tharu and other indigenous groups of inhabitants. There was a long tradition of eating pig meat in the family during Maghi celebration. Pigs were raised by most of the households as a preparation for Maghi. In addition people also raised ducks to take advantage of the aquatic situation during summer. Thus, both pigs and ducks which were the amplifying agents of JE transmission were present in the community. The knowledge, behavioural and low income factor has also contributed to increase JE incidence and impact. People have poor knowledge about JE transmission and general symptoms. People did not seek immediate health care from local health system expecting the patient to recover after a few days. In addition, due to lack of cash in hand or provision of health insurance, poor HHs have to incur time loss in course of financial management such as seeking loans with relatives or local money lenders. Both these factors caused worsening of the condition of the patient resulting in longer days for recovery, greater treatment cost, life long disability or even

death of patient The above circumstances leads to the conclusion that JE is a disease of the poor and a rural based disease

The economic burden on the JE HH which is the resource cost ofJE comprises of the direct cost and the indirect cost. The direct cost is the out of pocket cost while the indirect cost is the cost of

the income of the HH foregone due to JE incidence. The direct cost is more tangible and more accounted whJle the indirect cost is intangible and is not accounted rigorously by the JE HH The i-mpact of both the costs is, however, significant. The average direct cost ofJE treatment is RJS. 5281. This is a large amount in consideration with the subsistence level of incomes Since JE inflicts the HH during peak agricultural season, it reduces productivity of the HH. A comparison reveals that the minimum resource cost exceeds the per capita income as shown in the diagram below



Fig! Comparision of Per Capita Income Level and Minimum Resource Cost

The diagram reveals that the per capita income level for most of the HH is below the absolute poverty level while the minimum resource cost is above the absolute income level for most of the JE HHs. Higher resource cost has a long term impact on the HH and pushes the non poor to the poor and poor to the hard core poor category creating a downward poverty spiral. Increasing poverty acts as a bottleneck in the development of the society. This hampers the long term development of the society.

The objective of the local health system is to reduce DALY caused by a disease to its minimum. DALYs represent the loss of years of healthy life i.e. human capital loss. The study reveals that DALY is relatively high. The total DALYs lost by the sampled HH is 494. The DALYs reduced by the local health system is 366. Principally, the DALYs reduced by health services

should be larger than the total DALYs lost. The result contradicts with this principle implying that the local health system has low efficiency. Higher the DALYs, higher is the human capital loss and consequently low productivity.

Increasing incidence of a disease also leads to greater burden to the local health system (Adhikari et al., forthcoming). Increasing incidence of JE leads to greater bed occupancy, time of the health personnel and resources of health system by JE patients. This leaves less resources in terms of time, beds and money for the treatment of other diseases in an already resource constrained health system. Thus JE leads to greater burden in the local health system. The multi-dimensional impact of JE is shown in the following diagram.

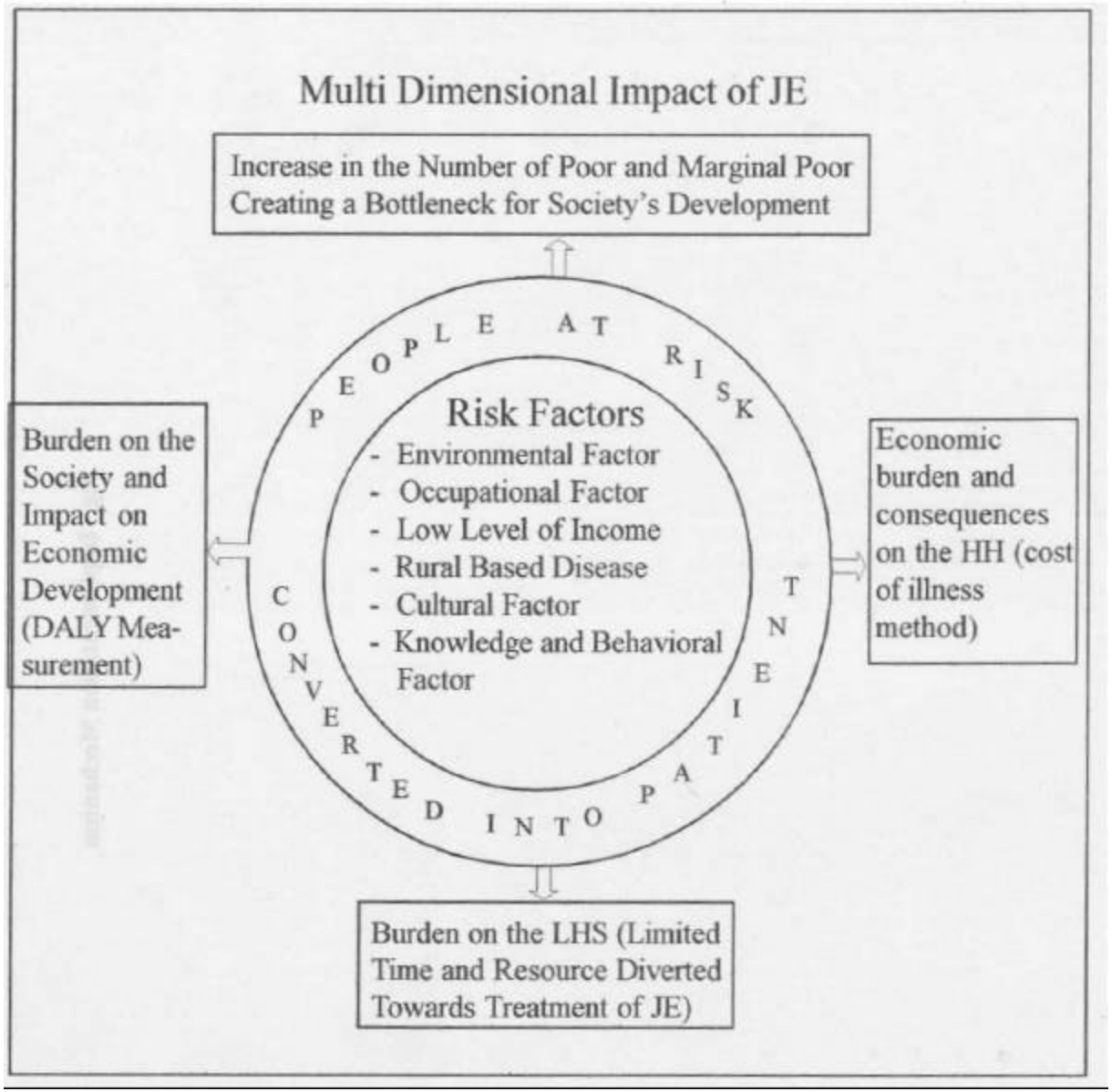


Fig: Implementation Mechanism

Chapter IV
Conclusions and Recommendations

4.1 Conclusions

JE is emerging as a serious public health problem in Nepal ~ The diagnosis and treatment of the JE patient has financial consequences on the HH, LHS and the society, An economic study on JE was conducted in a small area in Kailali district. The specific objectives of the study were to: determine the sources and levels of income of the JE HH, measure the direct and indirect costs incurred by HH to obtain preventive, diagnostic and curative services to JE, identify the socio-economic factors responsible for JE transmission and suggest policy recommendations for prevention, control and treatment of JE.

The study was based on primary as well as secondary sources However, the study relied mainly on primary data. For primary data, 60 JE HH, 30 male and 30 female, randomly selected from the list of JE patients from the hospital records. Pre-designed, pre-tested questionnaires were administered to collect quantitative information from the sampled HH. Focus group discussion with health personnel, JE patients, caretakers and key informants were also conducted. DALY calculations are have been made using the formula outlined by Murray. The study also used information from secondary sources.

Agriculture and wage earning were the main source of incomes of the JE HH and the average HH income was Rs. 48671. Using the poverty line income Rs. 4404 at constant price of 1996 (Rs. 5759 at current price), the proportions of sample population under absolute poverty line was found to be 66.67 percent. The Ginni Coefficient which measures the size distribution of income among the HH on the basis of per capita income was found to be 26.25 percent which is relatively lower than the national scenario (34 percent). Similarly, the Ginni CoefFecient among the absolute poor is relatively lower (15.49 percent) than that for sampled HH.

The direct cost which is the out of pocket cost of JE treatment involves medical cost) transportation cost, and food expenses. The average total direct cost was Rs. 5281 per patient. The medical cost was the largest component in the direct cost. Indirect cost which refers to the time lost and consequently income loss by the JE *patient and* the *caretakers in the* economically active age group (15-59 years) was calculated. The average total time *loss* of the HH *was 90 person* days. The average monetary value of the time lost by the JE HH was found to be Rs. 5332

The resource cost defined as sum of the direct cost and the indirect cost was 49.87 and 50.13 percent, respectively. The average total resource cost was almost 15 percent of the average annual

income of the JE HH. DALYs which measure the years of healthy life lost due to a disease showed the total DALYs lost was 49392. The study estimated a DALY of 365.70 reduced as a result of treatment provided by local health system. The study while analysing the determinants of JE categorized environmental factor, occupational factor, income (poverty) factor, knowledge and behavioural factor and cultural factor as determinants of JE transmission. Eighty percent of the case incidence occur during July-September.

It can be concluded that JE is a rural based disease and a disease of the poor. It imposes a burden on the HH as well as the local health system. JE has an impact not only on the income but on the sources of income as well which effects their future income flow and prospects of a better future. This aggravates the poverty situation in the society. Thus JE has serious impacts on the short run as well as the long run in the society.

4.2 Recommendations for Policy Interventions

JE is a serious public health problem and its root lies in the socio-economic factors i.e. risk factors JE incidence creates multidimensional impacts such as increase in the number of the marginal poor, economic burden and consequences on the JE HH, burden on the society and the burden on the local health system The targets of the intervention will be reducing the risk factors of JE, reducing the number of marginal poor, reducing the economic burden and consequences on the JE HH, reducing the burden on the society and reducing the burden on the LHS The risk factors identified are environmental factors, occupational factors, cultural factors, knowledge and behavioral factor and income factor. Changes in the above mentioned risk factors are the pre-requisites for reducing the risk of JE. Bringing about changes in the first three factors is a requires long periods of time and is a continuous process. It may be relatively easier to bring changes through intervention in case of the remaining factors. Certain programmes are necessary to meet the above mentioned targets which have been discussed below.

- **Programmes for awareness and behavioural changes;** These Programmes to raise awareness and bring behavioural changes can be conducted through local health system, local NGOs, Community Based Organizations (CBOs), Mother's Group, Female Community Health Volunteers (FCHVs), local clubs, schools etc. These programmes should focus on creating awareness and behavioural changes on the following aspects.

  At the HH level:

  - general symptoms ofJE (see appendix B)
  - Crucial role of pigs and ducks as the amplifying hosts of JE
  - Avoiding outdoor activities during twilight periods when JE transmitting mosquitoes are most active

- Use of toilets to prevent mosquito bites
- Immediate visit to the hospitals after appearance of symptoms
- Special attention to avoid mosquito bite during peak season of JE transmission through measures such as avoiding outdoor sleep, protective clothing to children etc.

At the community level:

- Improving the drainage system, filling up ditches near settlements to prevent mosquito breeding.
- Community management of pig keeping at a distant place, encouraging purchase of pigs from outside during Maghi and vaccination to pigs
- Awareness campaigns about precautions against JE at schools during peak season

- **Poverty Alleviation Programmes:** JB is a rural based diseases and the disease of the poor and should be tied up with poverty alleviation programmes. Since JE creates a downward poverty spiral, JE is a risk factor of poverty. Institutions concerned with poverty alleviation need to realize that health program prevent non poor from falling into poor and poor into hard core poor. Thus health enhancing programs are equivalent to income generating programs. Health insurance should be provided a status equal to compulsory saving Grameen bank type of institutions.
- **Vaccination and Surveillance Programmes:** The vaccination and epidemiological surveillance programmes should be further strengthened. Since, vaccination programme have been found cost effective in some countries (Bista and Shrestha, 2001), it may be emphasized. Not only humans but pigs also should be vaccinated.
- **Improving Capacity of the Local Health System (LHS):** the LHS has a major part to play in prevention and cure of diseases. It can reduce the economic burden on the HH and burden of disease on the society. Strengthening the capacity of the LHS in terms of required manpower, control absenteeism and fulfillment of vacancies. The national budget allocation on health sector need to be increased. (for further justification see Adhikari et. al,, 2002)
- **Coordination between government line Agencies:** Coordination between government tine agencies is necessary such as livestock services, irrigation, education and health services for the consideration and more effective implementation of other possible control measures.
- **Use of natural Measures of vector Control:** The technique of larvivorous (mosquito) fish may be applicable impermanent water bodies in controlling vector. In relation to rice

cultivation, the temporary nature of water availability and vast area coverage may require mass scale rearing and rapid periodic release through central/local community and /or involvement of communities,

The recommended programs can be implemented through the following diagram, (see next page)

Solving public health problem requires intervention from both the demand and the supply side. It means the community as well as HHs and the government both have to participate equally to address this public health problem. In the absence of active participation of the HHs, such programmes cannot produce desired results. The recommended policies are complementary rather than competitive with each other. Hence these policies should be implemented simultaneously.

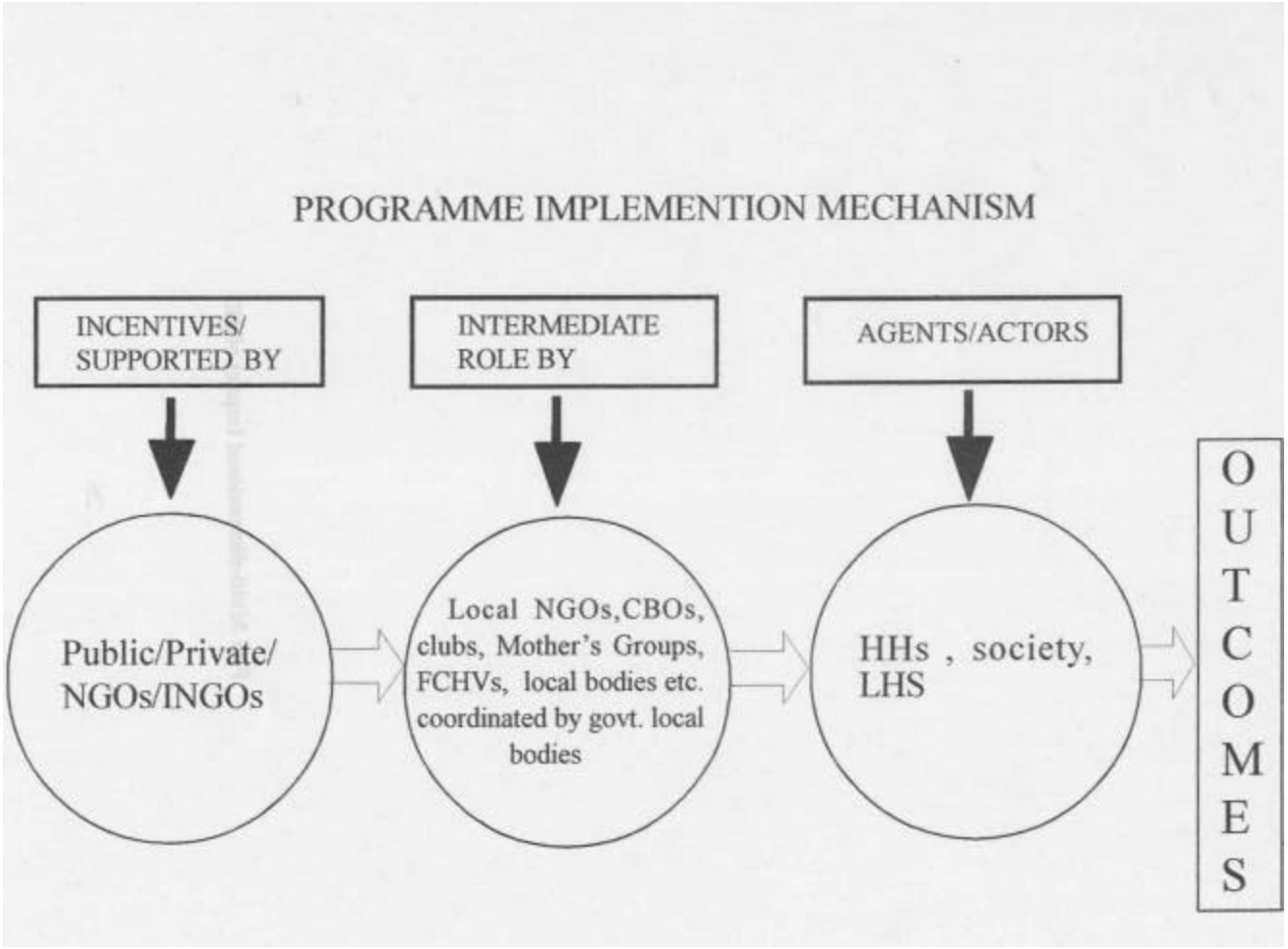


Fig: Multi-dimensional Impact of JE

APPENDICES

APPENDIX A: Analysis Tables

Table No 1

Average Direct Cost of JE HH (in Rupees)

Category	Medical Cost	Transport Cost	Food Expenses	Total Direct Cost
Male	3549.033 (2504.516)	429.467 (471.397)	756.80 (614.501)	**4682.30** **(3624.561)**
Female	4112.27 (1439.34)	464.867 (363.354)	1249.667 (756.756)	**5826.80** **(1804.521)**
Total	**3830.65** **(2045.014)**	**447.167** **(417.657)**	**1003.233** **(727.221)**	**5281.05** **(2291.246)**

Table No 2

Test of Significance at 5% level

Category	Medical Cost	Transportation Cost	Food Expenses	Total Direct Cost
Direct Cost of Male and Female	**Null Hypothesis Accepted**	**Null Hypothesis Accepted**	**Null Hypothesis Rejected**	**Null Hypothesis Accepted**

Note: Null hypothesis is that there is no difference between means

Table No. 3

Average Time Lost by Patient and Care-takers (in Person Days)

Category	Patient	Caretaker			Total time loss of JEHH
		Male	Female	Total	
Male	40.867 (25.577)	14.967 (12.464)	20.90 (21.775)	35.867 (26.051)	**76.733** **(48.263)**
Female	52.633 (34.126)	22.533 (16.835)	27.113 (34.939)	49.667 (44.131)	**102.3** **(73.950)**
Total	**46.75** **(30.075)**	**18.75** **(15.173)**	**24.017** **(29.040)**	**42.767** **(36.596)**	**89.517** **(63.24)**

Table No. 4

Test of Significance at 5% level

Category	Patient	Caretaker	Total Time Loss
Time loss of Male and Female	**Null Hypothesis Accepted**	**Null Hypothesis Accepted**	**Null Hypothesis Accepted**

Note: Null hypothesis is that there is no difference between means

Table No 5

Average Monetary Value of Time Lost by Patient and Care-takers (in Rupees)

Category	Patient	Caretaker			Total value of time lost of JEHH
		Male	Female	Total	
Male	1746.667 (2342.049)	1220.667 (1010.316)	1392.333 (1411.853)	2613.00 (1735.303)	**4359.667 (3200.432)**
Female	2356.833 (2976.111)	2270.333 (1737.121)	1676.333 (2347.522)	3946.667 (3162.504)	**6303.50 (5532.437)**
Total	**2051.75 (2672.887)**	**1745.5 (1505.011)**	**1534.333 (1925.878)**	**3279.833 (2616.922)**	**5331.583 (4586.911)**

Table No. 6

Test of Significance at 5% level

Category	Patient	Caretaker	Total Monetary Value of Time Loss
Monetary value of Time loss of Male and Female	**Null Hypothesis Accepted**	**Null Hypothesis Accepted**	**Null Hypothesis Accepted**

Note: Null hypothesis is that there is no difference between means

Table 7

Average Direct and Indirect Cost of JE HH (in Rupees)

Category	Direct Cost	Indirect Cost	Total
Male	4735.30 (2609.237)	4359.667 (3200.432)	**9094.967** **(4878.86)**
Female	5826.80 (1804.521)	6303.50 (5532.437)	**12130.30** **(6146.067)**
Total	**5281.05** **(2291.246)**	**5331.583** **(4586.911)**	**10612.63** **(5710.448)**

Table No. 8

Test of Significance at 5% level

Category	Direct Cost	Indirect Cost	Total Cost
Direct and Indirect Cost of Male and Female	**Null Hypothesis Accepted**	**Null Hypothesis Accepted**	**Null Hypothesis Accepted**

Note: Null hypothesis is that there is no difference between means

Table No. 9

Average HH Annual Income and Per Capita Income (in Rupees)

Category	HH income	Per Capita Income
Male	45012.40 (56999.1)	4767.034 (2197.147)
Female	52329.60 (34620.73)	6461.17 (4074.403)
Total	**48671.00** **(46900.615)**	**5614.102** **(3355.92)**

Table No 10.

Test of Significance at 5% level

Category	HH income	Per Capita Income
Annual HH income and Per Capita Income of Male and Female	**Null Hypothesis Accepted**	**Null Hypothesis Accepted**

Note: Null hypothesis is that there is no difference between means

Table No. 11

Correlation Co-efficient between Variables

Category	Medical Cost and Patient time loss	Food Cost and Real income	Patient time lost and Disability index	Household size and Household income	Total Direct Cost and Loan
Male	0.44	0.23	0.17	0.71	0.37
Female	0.08	0.14	0.37	0.60	0.11
Total (r)	**0.27**	**0.24**	**0.23**	**0.70**	**0.29**
Comparison between (r) and Probable Error (P.E.)	**r > P.E.**	**r > P.E.**	**r > P.E.**	**r > P.E.**	**r > P.E.**

Note: Probable error (PE) = $0.6745\ (1-r^2)\ n^{1/2}$

If the value of r is less than the P.E, there is no evidence of correlation i.e. the value of r is not at all significant

APPENDIX B: Some Major Signs and Symptoms of JE

A. Early Symptoms

1 Fever
2 Rigor
3. Headache
4. General mala ise
5 Nausea
6. Vomiting

B. Late Signs and Symptoms (Acute encephalitis stage, usually between the third -fifth day)

1. Altered sensorium (clouding of consciousness, excitement, confusion disorientation, stupor and coma)
2. Convulsions
3. Stiff neck
4. Muscular rigidity
5. mask like face
6. Abnormal movements (coarse tremor, chorea-athetotic movements etc.)
7. Dehydration
8. Weight loss

C Other signs and symptoms (early or late)

1. Increased deep tendon reflexes
2. Thick, slow speech
3. Aphasia
4. Paresis and /or paralysis

Appendix C: Treatment and Management of JE

- No specific treatment is indicated. Supportive and symptomatic treatment is indicated,
- Meticulous nursing care is most important.
- If the patient is unconscious, a Ryle's tube has to be introduced.
- 1.V. fluid has to be avoided.
- Avoid indwelling catheter in conscious patient
- Dextrose solution is to be considered if there is dehydration.
- In case of raised cranial pressure, 20°'o Mannitol injection to be given 8 hourly for 48 hours (pediatric dose: 1.5 gm/kg can be given 8 hourly).
- Antibiotics can be used only if the patient is having secondary infection.
- Coiticosteroids should be avoided
- In case of convulsion, give Diazepam injection or Phenobarbitone.

Appendix D: Diagnostic methods of JE

- At HP levels, diagnosis will be made based on the clinical features presented by the patient If classified as POSSIBLE MTNINGITIS/ENCEPHALITIS, the case needs to be referred to a more specialized treatment facility.

- At PHC, District and Zonal Hospitals, patients meeting the case definition of POSSIBLE MENINGITIS/ENCEPHALITIS, will be subjected to lumbar puncture for CSF. CSF should be examined for ceil count, protein, sugar, gram and ZN stains, and culture wherever possible.

- In absence of skilled laboratory technician, lumbar puncture must be carried out to look out for pressure, turbidity and cell count.

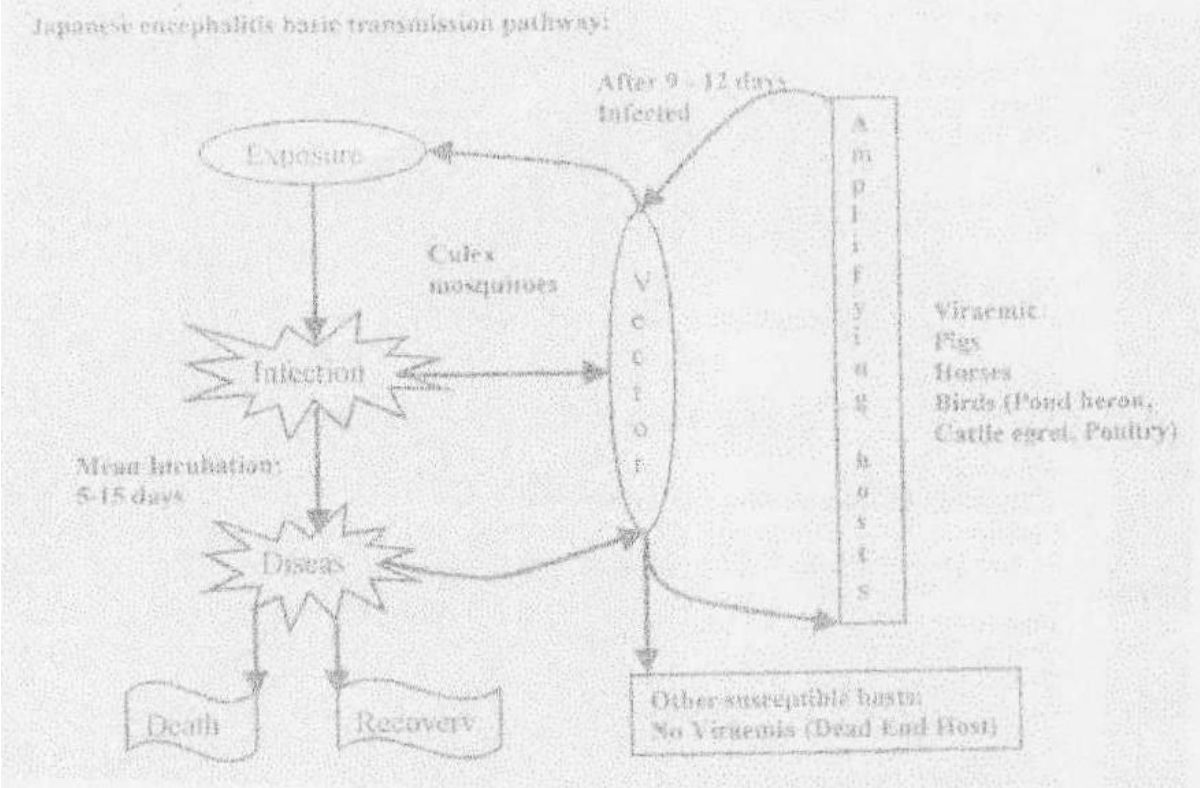
- Serum specimens for specific IgM to be detected, should be collected and referred to the National Public Health Laboratory, Teku, Kathmandu, following the guidelines according to the protocol for the collection, storage and transportation of laboratory specimens .

- Japanese encephalitis is an obligatory notificable disease, which needs to be reported within 24 hours after detection, to the Epidemiology and Disease Control Division, Teku (Tel. 262268, 255796, Fax. 262268) or to the Vector Borne Disease Center, Hetauda (Tel. 057-20572, Fax. 057-20484) by the institution chief.

(Source: Bista et. al)

Appendix E: Japanese Encephalitis Transmission

Japanese Encephalitis Basic Transmission Pathway:



Source: (Bista and Shrestha, 2001)

APPENDIX F: Questionnaires and Guidelines

Questionnaire for Household Information

This questionnaire has been prepared for administration at the households of the patients who had undergone treatment against Japanese Encephalitis (JE). The objective of this study is to identify the socio-economic factors responsible for JE transmission and to in the endemic area and to measure the economic burden on the JE household due to morbidity and mortality. This study is being undertaken under the Nepal Health Research Council (NHRC), This study is based on the information provided by households on the workdays lost due to sickness, expenses incurred in the treatment and other related information.. The information provided by the individual households will be kept confidential. The information provided by individual households will be used in the preparation of a report and the findings will be used only for policy purposes. The information published in the report will be in the form of group data rather than individual data. The households have every right to agree or disagree to provide the information.

Acceptance by the respondent

After reading/listening the questionnaire and the information given above, I agree to provide the necessary information.

Name of the respondent;

Address:

Signature:

Date:

Name of the Interviewer:

Questionnaire for Japanese Encephalitis (JE) Household (HH) Survey

Method: Data related to direct and indirect cost of JE on the HH is collected through interview with the sample JE HH after obtaining permissions from the JE HH. In case of any sampled HH refusing to provide information or concerned members of the sampled HH not being available at the spot, the nearest JE HH with similar characteristics will be selected in their places. At least the HH head, caretaker, JE patient (if the JE patient is not a child) and other members who are involved in Financial decision making in the family should be involved while conducting interview. This is necessary as there is no system of keeping account of HH income and expenditures in rural Nepal. Answers of one respondent may be crosschecked through verification by other members of the family. The answer of the head of HH, however, will be given priority to maintain uniformity. Before starting the interview, the team will build rapport with the family and explain the importance and objectives of this study The respondents are assured that all the information given by them will remain strictly confidential and will be used only for the purpose of this study. JE patients in below 15 years age group shall be considered as "Children"

District: VDC: Ward No:

Village/Tole:

Part A: Direct and Indirect Cost Related to JE Patient

1. General Information about the JE Patient

Informant:

Mention the HH head, JE patient, caretaker and persons involved in providing information

Name: a. Name of HH head:

b. Name of caretaker:

c Other members of the HH:

1.1 Name of the patient: .....……

1.1.1 Age: ...…….....years

1.1.2 Education:....…….....

1.1.3 Caste/ethnic group……