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ORIGINAL ARTICLE

EPIDEMIOLOGICAL PROFILE OF JAPANESE ENCEPHALITIS IN TAMIL NADU, 2022-2024: A SECONDARY DATA ANALYSIS OF IDSP-IHIP PROGRAMME DATA

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ABSTRACT

INTRODUCTION : The Japanese encephalitis virus (JEV) is a significant etiological agent of viral encephalitis in Asia. JEV is a zoonotic, vector-borne virus transmitted mostly by Culex (Cx) subgroup of mosquitoes. This study aims to delineate the epidemiological profile and assess the trends of JE incidence from 2022 to 2024.

METHODS : To analyse the epidemiological profile of Japanese encephalitis cases in Tamil Nadu, India, during 2022 - 24. The data of confirmed Japanese encephalitis (JE) cases in Tamil Nadu was retrieved from the IDSP- IHIP portal and entered in MS- Excel. Statistical analysis was done using SPSS version 21.0. Descriptive statistics was used.

RESULTS: From January 2022 to December 2024, 306 confirmed cases of Japanese encephalitis were reported in Tamil Nadu, with the majority aged 10-19 years. The proportion of male cases reported was higher than females. Chennai had the highest proportion at 40.5%, followed by Thiruvallur at 8.2% and Thiruvarur at 6.2%. The highest number of cases (120) occurred in 2022, followed by 112 in 2023 and 74 in 2024. The Health and Family Welfare Department of Tamil Nadu has identified 14 districts as endemic, but between 2022 and 2024, there was a noticeable increase in cases outside these districts also.

CONCLUSION: Japanese encephalitis virus shows a recurring seasonal trend with more cases from December and January, and it correlates with the post monsoon season of the region. This recurring seasonal trend underscores the importance of implementing preventive measures, such as mosquito control and public vaccination campaigns, before the monsoon season begins.

KEYWORDS : Japanese encephalitis, Vector-borne

INTRODUCTION

The Japanese encephalitis virus (JEV) is a significant etiological agent of viral encephalitis in Asia. JEV is a zoonotic, vector-borne virus transmitted mostly by Culex (Cx) subgroup of mosquitoes like Cx.vishnui, Cx. Vishnui, Cx.pseudovishnui, and Cx.tritaeniorhynchus. It is an arbovirus belonging to family Flaviviridae, closely related to West Nile, St. Louis & Kunjin viruses. Numerous avian species serve as the natural reservoir; however, swine are regarded as the primary maintenance or amplifying host. Man is the accidental host.[1,2.]

JE persists as a public health concern owing to vector proliferation, reservoir host availability, deficiencies in vaccine coverage, environmental influences, and insufficient surveillance and reporting mechanisms. Vaccination initiatives in Asia encounter obstacles, particularly in resource-constrained environments. Environmental elements such as rice agriculture and irrigation establish optimal breeding conditions for mosquitoes.

JEV infection in humans typically results in mild febrile sickness, whereas around 1% of infected individuals progress to Japanese encephalitis (JE), which has a death rate nearing 30%. The disease has a significant incidence of neurological sequelae, with 25–30% of survivors experiencing enduring disability or cognitive impairments.[3,4]

The World Health Organisation (WHO) estimates that there are 68,000 cases of Japanese Encephalitis (JE) worldwide each year. Additionally, around three billion individuals are projected to reside in regions endemic to JE5,6. Asymptomatic instances to severe encephalitis with fever, headache, and vomiting are possible with Japanese Encephalitis (JE).

Cervical rigidity, disorientation, seizures, spastic paralysis, and coma may develop as the condition progresses.[7] Approximately 75 percent of the impacted persons generally develop seizures. To date, no specific treatment exists for JE,

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and immunisation remains the sole dependable method for its prevention and control. The predominant vaccination utilised against JEV genotype III (GIII) is employed in endemic nations.[8-10]

The virus is extensively prevalent in Southeast Asia, mostly in rural and peri-urban areas where humans reside in close proximity to vertebrate hosts such as pigs and waterfowl.[11,12]

In temperate sections of Asia, transmission primarily happens during the warm season, although in tropical and subtropical places, it can transpire throughout the year, frequently escalating during the rainy season and pre-harvest period in rice-cultivating regions.[13,14]

In India, Japanese Encephalitis has persisted as a significant public health issue since its initial identification in Nagpur, Maharashtra, in 1952.

Consequently, the aggregation of serological evidence in southern India in 1955 led to the reporting of cases from approximately 16 states, including Andhra Pradesh, Assam, Bihar, Delhi, Goa, Haryana, Karnataka, Kerala, Maharashtra, Manipur, Nagaland, Punjab, Uttarakhand, Tamil Nadu, Uttar Pradesh, and West Bengal.[15,16] Currently, 24 States and Union Territories in the country have recorded instances of Japanese Encephalitis (JE), with Uttar Pradesh accounting for almost 75 percent of cases in 2007. The outbreak has caused widespread infection nationwide, with case fatality rates nearing 50 percent.

Following the significant outbreak documented in Tirunelveli, southern India, in 1978, JEV was identified as endemic in many regions of Tamil Nadu17. JE is endemic in multiple districts of Tamil Nadu. The aforementioned retrospective investigation documented JE instances from multiple districts, including Chennai, Thiruvallur, Kancheepuram, Vellore, and Thiruvannamalai. The predominant instances originated from the northern regions of Tamil Nadu.

In addition to Tamil Nadu, JE has been recorded in Andhra Pradesh and Karnataka. Conversely, it has been identified as a significant public health issue with an increasing trend of case incidence in northern India. Insufficient surveillance systems and underreporting impede effective public health measures.[18,19]

A comprehension of the seasonal pattern of JE would facilitate the anticipation of the disease burden. This would assist public health authorities in implementing suitable measures to control and avoid future outbreaks. This study aims to delineate the epidemiological profile and assess the trends of JE incidence from 2022 to 2024.

METHODS

This retrospective analysis utilised surveillance data of Japanese Encephalitis cases. The data was obtained from the IDSP – IHIP portal (Integrated Disease Surveillance Programme - Integrated Health Information Platform) of Tamil Nadu, from January 2022 to December 2024. Authorisation was secured from the Director of Public Health and Preventive Medicine (DPH & PM), Tamil Nadu, for the utilisation of secondary surveillance data. During the study period from January 2022 to December 2024, a total of 306 cases of Japanese Encephalitis were identified through various Rapid antigen tests and IgM ELISA for Japanese Encephalitis. The line list included the epidemiological and laboratory profiles of all the cases. The details of the patients were not disclosed in this study.

The monthly and yearly data of Japanese Encephalitis cases was manually entered into MS Excel, and statistical analysis was conducted utilising IBM SPSS Statistics, version 21. Data on a categorical scale was expressed in numerical values and percentages, whereas data on a continuous scale was represented as Mean ± SD.

Trend analysis was done from January 2022 to December 2024. District wise prevalence of Japanese encephalitis was analysed. However, vaccination status and outcome data were available for only 95 cases, so only descriptive analysis was performed.

RESULTS

From January 2022 to December 2024, the IDSP-IHIP portal reported 306 confirmed cases of Japanese encephalitis. The mean age of the JE cases was 23.59 years (± 21.4). Table 1 illustrates the age and gender wise distribution of Japanese encephalitis cases. The majority of cases were in the age group of 10 to 19 years (24.2%), followed by those under 5 years (19.0%). Table 1 indicates that, among the 306 recorded cases of Japanese encephalitis, the proportion of males (62.04%) exceeded that of females (37.06%).

Table 1: Distribution of Japanese encephalitis cases by Age and Gender in Tamil Nadu between 2022 and 2024. (N=306)

Age (Years)	Frequency (N=306)	Percentage (%)
Under 5	58	19
6 to 9	51	16.7
10 to 19	74	24.2
20 to 40	51	16.7
40 to 60	39	12.7
Above 60	33	10.8
Sex		
Male	191	37.6
Female	115	62.4

The district-wise distribution of Japanese encephalitis cases in Tamil Nadu indicates that Chennai

accounts for the highest proportion at 40.5%, followed by Thiruvallur at 8.2%, Thiruvarur at 6.2%, Thiruvannamalai at 5.6%, Chengalpattu at 4.9%, Thanjavur at 4.6%, Villupuram at 3.6%, and Madurai at 2.6%. The remaining districts depicted in Figure 1 exhibited less than 2%. The highest number of cases occurred in 2022, with 120 cases, followed by 2023 with 112 cases, and 2024 with 74 cases. (Figure 1)

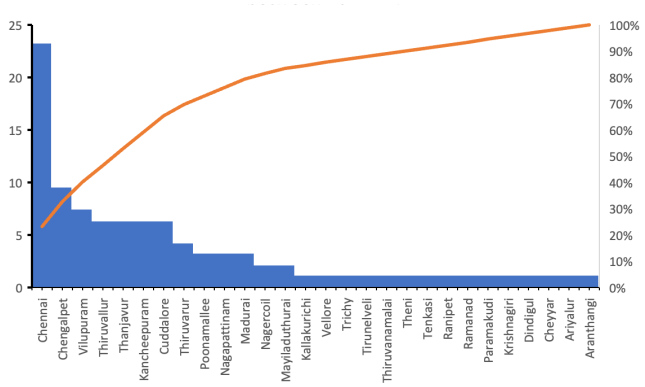

Figure 1: Distribution of Japanese encephalitis cases by district in Tamil Nadu between 2022 and 2024 (N=306)

Comparing the monthly data of Japanese encephalitis cases from 2022 to 2024 reveals that JE cases begin to increase from June with a slight decrease of cases in September, increasing thereafter with an increase in December and January. This bimodal peak is consistent for all three years. (Figure 2)

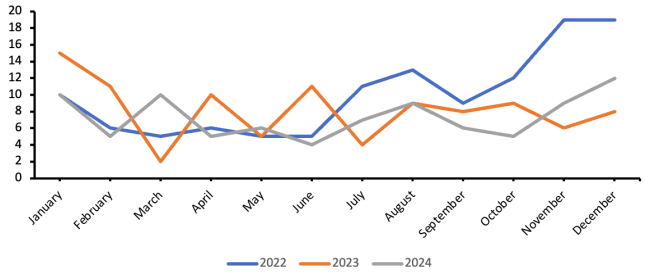

Figure 2: Trend of Japanese encephalitis in Tamil Nadu between 2022 and 2024

The Health and Family Welfare Department of Tamil Nadu has identified 14 districts as endemic such as Tiruvallur, Tiruvannamalai, Villupuram, Cuddalore, Kallakurichi, Perambalur, Karur, Thanjavur, Ariyalur, Tiruvarur, Pudukkottai, Madurai, Virudhanagar, and Tiruchirappalli. Between 2022 and 2024, there has been a noticeable increase in cases (>5 cases) in districts outside of endemic areas such as Chennai, Kanchipuram, Chengalpattu and Tenkasi. Assessing the outcomes of 95 cases (which could only be done due to feasibility) from 2022 to 2024 shows a significant recovery rate, with 82 patients (86.3%) recovering completely. However, 5 patients (5.3%) experienced neurological sequelae despite survival, and 8 patients (8.4%) succumbed to the condition as shown in Table 2.

Table 2: Outcomes of Japanese encephalitis cases in Tamil Nadu between 2022 and 2024.

Outcome	Frequency (N=95)	Percentage (%)
Recovered	82	86.3
Recovered with neurological sequelae	5	5.3
Death	8	8.4

Among the 95 cases of JE reported between January 2022 and December 2024, 17 patients had received the vaccine, whereas 78 remained unvaccinated as mentioned in Table 3.

Table 3: Vaccination Status of Japanese encephalitis cases in Tamil Nadu between 2022 and 2024.

Vaccination Status	Frequency (N=95)	Percentage (%)
Yes	17	17.8
No	78	82.2

DISCUSSION

Japanese encephalitis (JE) is a viral illness that is transmitted by mosquitoes and presents a serious problem in Tamil Nadu in terms of public health. Throughout the years, the Directorate of Public Health and Preventive Medicine of the state has tracked the number of cases and fatalities associated with JE. There were 33 cases and five fatalities in 2012; 33 cases without death in 2013; 36 cases and three deaths in 2014; 53 cases with no death in 2015; and 51 cases with no death in 2016.

To improve the surveillance of the disease, JE cases are reported in the IDSP – IHIP portal on daily real-time basis in India. Surveillance data was retrieved from the IDSP-IHIP portal to understand the trends of leptospirosis in the state of Tamil Nadu. The study reveals that 306 confirmed cases of Japanese encephalitis (JE) were reported in Tamil Nadu, with the majority aged between 10 and 19 years. The highest proportion of cases (24.2%) was recorded in the 10 to 19 year age group, while children under 5 years (19.0%) were the second highest affected group. Campbell et al. examined the global burden of Japanese encephalitis and found that most of symptomatic JE cases occur in children under the age of 15 years, particularly in areas where vaccination coverage remains suboptimal. This aligns with the current findings in Tamil Nadu, where a significant proportion of cases (24.2%) is observed in children and adolescents under

19 years, suggesting importance of mandatory vaccination of JE.[20] According to WHO, in endemic areas adults have likely developed natural immunity due to childhood infection, but children under 15 haven't had the chance to develop this immunity yet, making them more susceptible.

The data also shows gender disparity in JE cases, with males having a higher incidence (62.04%) compared to females (37.06%). This could be due to greater outdoor exposure; Similar observations were made by Kumar et al. who on analysing JE trends in India reported that males accounted for approximately 60% of JE cases. The study linked this gender disparity to increased outdoor activities such as farming and livestock tending, particularly in rural areas where mosquito density is higher.[21] The seasonal pattern of Japanese encephalitis (JE) cases observed between 2022 and 2024 aligns with findings from previous studies conducted in endemic regions of Tamil Nadu by Tiroumourougane et al., where higher JE cases during the post-monsoon and winter months are attributed to increased mosquito breeding, particularly of Culex species, which are primary JE vectors.[22] The geographical distribution of JE cases is mainly urban, with Chennai recording the highest number (40.5%). Other districts have varying proportions, with Chennai having the highest number (40.5%). A region-specific study by Tiwari et al. on JE in South India found that while rural districts accounted for a majority of cases historically, metropolitan areas, including Chennai, showed a rising trend. This was attributed to the encroachment of agricultural practices in peri-urban zones, climate-related changes increasing mosquito activity, and migration patterns that expose urban populations to rural reservoirs of infection.[23] Districts namely Tiruvallur, Thiruvarur, Tiruvannamalai and Thanjavur share common agricultural characteristics, with a strong dependence on farming and irrigation. The Cauvery Delta region (Thanjavur & Thiruvarur) is more dependent on paddy, while Tiruvallur & Tiruvannamalai have a mix of crops. The presence of water bodies, monsoonal dependency, and rural agricultural livelihoods connect them, making them more vulnerable for JE. The increasing number of cases in previously non-endemic regions can be attributed to several environmental and ecological factors that contribute to the spread of Japanese Encephalitis Virus (JEV). Key factors include the presence of paddy fields, bird sanctuaries, field wells, pig populations, and ardeid bird habitats, all of which create an ideal environment for mosquito breeding and disease transmission. Additionally, bird sanctuaries and ardeid bird habitats (such as herons and egrets) play a crucial role in the JEV transmission cycle, as these birds serve as reservoir hosts for the virus. The presence of pig populations, which act as amplifying hosts, further escalates the risk of transmission, as infected pigs can significantly increase the virus load in local mosquito populations. Despite the results indicating a high recovery rate among patients, a significant concern remains the development of serious neurological sequelae in recovered individuals. These neurological complications can lead to long-term disabilities, severely affecting the patients' ability to perform daily activities independently. As a result, many survivors experience cognitive, motor, or speech impairments, which hinder their normal lifestyle and significantly reduce their quality of life. The burden of such disabilities extends beyond the affected individual, placing a significant financial and emotional burden on family and the society. Therefore, preventing JE through effective vaccination is crucial to reducing the disease burden and its long-term consequences. However, due to limited data association between vaccination status, occurrence and outcomes could not be done which paves a scope for further study. This study reveals that Japanese encephalitis (JE) in Tamil Nadu is a persistent public health challenge, with a significant age group vulnerability, post monsoon seasonal trend and gender disparity. The study recommends enhanced vaccination coverage and monitoring, targeted public health interventions, geographically-focused control measures, investigation into urban risk factors, and the need for pre-monsoon preventive measures, including intensified mosquito control, vaccination drives, public awareness campaigns, real-time surveillance, and further research and policy development. By implementing these measures, Tamil Nadu can strengthen its public health response to JE, reduce disease incidence, and protect vulnerable populations more effectively.

CONFLICT OF INTEREST

None

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