BMJ Open  Extent of disability among paediatric Japanese encephalitis survivors and predictors of poor outcome: a retrospective cohort study in North India

Neha Srivastava,1 Hirawati Deval Ⓣ,1 Mahima Mittal,2 Avinash Deoshatwar,3 Vijay P Bondre,3 Rajni Kant,1 Rajaram Yadav1

ABSTRACT

Objective To determine the Japanese encephalitis (JE)-associated long-term functional and neurological outcomes, the extent of reduced social participation and predictors of poor outcomes among paediatric JE survivors.

Design A retrospective cohort study.

Setting Laboratory-confirmed JE-positive paediatric cases (<16 years of age) hospitalised at the paediatric ward of Baba Raghav Das Medical College, Gorakhpur, India, between 1 January 2017 and 31 December 2017, were followed up after 6–12 months of hospital discharge.

Participants 126 patients were included in the study; median age was 7.5 years (range: 1.5–15 years), and 74 (58.73%) were male.

Outcome measures Functional outcome defined by Liverpool Outcome Score (LOS) dichotomised into poor (LOS≤1–2) and good (LOS=3–5) outcome groups compared for demographic, clinical and biochemical parameters for prognostic factors of poor outcomes. Social participation of patients scaled on Child and Adolescent Scale of Participation score 2–5.

Results About 94 of 126 (74.6%) children developed neurological sequelae at different levels of severity. Age-related social participation was compromised in 90 out of 118 children. In multivariate logistic regression analysis, a combination of parameters, JE unvaccinated status (OR: 61.03, 95% CI (1.3 to 57.1); p=0.026), malnutrition (OR: 13.56, 95% CI (2.77 to 66.46); p=0.001) and requirement of endotracheal intubation (OR: 5.43, 95% CI (1.20 to 24.44); p=0.027) statistically significantly predicted the poor outcome with 77.8% sensitivity and 94.6% specificity. The goodness-of-fit test showed that the model fit well (Hosmer-Lemeshow goodness-of-fit test) χ² = 3.13, p=0.988, and area under the receiver operating characteristic curve was 0.950.

Conclusion This study estimates the burden of JE-presenting post-discharge deaths (15.4%) and disability (63.08%). Those who did not receive JE vaccine, were suffering from malnutrition, had GCS ≤8 at admission and required endotracheal intubation had poorer outcomes.

STRENGTHS AND LIMITATIONS OF THIS STUDY
⇒ The study used prevalidated questionnaire tools, that is, the Liverpool Outcome Score and Child and Adolescent Scale of Participation to assess the patients.
⇒ There were no missing data in the data sets for imputation.
⇒ However, this study has been conducted at a single-centre setting and with a limited sample size.

INTRODUCTION

Japanese encephalitis virus (JEV) causes a spectrum of functional and neurological impairment with significant morbidity and mortality.1 In India, Japanese encephalitis (JE) is principally a disease of children aged less than 15 years2 with a reported case fatality rate of 20%–30%.3 Among patients with JE, deaths are reported in 30%–35% patients, while long-term neurological impairment is reported in 22%–94% of the survivors. Since 1978, Uttar Pradesh (UP) state of India has been an epicentre for seasonal outbreaks of acute encephalitis syndrome (AES) having JE as a major aetiology.4 However, JE vaccination caused significant decline in JE incidence but sporadic cases still occur in the region.4 During the year 2017, UP reported 693 JE cases and 93 deaths, out of which 299 (43.4%) JE cases and 66 (71%) deaths were from the eastern part of UP.5 A significant proportion of JE disease burdens is caused by the long-term sequelae of the disease.6 These sequelae are in the form of functional disability, neurological deficits and cognitive behavioural deficits that severely impact the social participation of survivors.7 Guidelines for JE management emphasise on targeted supportive treatment, as there is no effective

To cite: Srivastava N, Deval H, Mittal M, et al. Extent of disability among paediatric Japanese encephalitis survivors and predictors of poor outcome: a retrospective cohort study in North India. BMJ Open 2022;12:e060795. doi:10.1136/bmjopen-2022-060795

© Author(s) (or their employer(s)) 2022. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

1ICMR-Regional Medical Research Centre, Gorakhpur, Gorakhpur, Uttar Pradesh, India
2Department of Pediatrics, All India Institute of Medical Sciences Gorakhpur, Gorakhpur, India
3ICMR, National Institute of Virology, Pune, Maharashtra, India

Correspondence to Dr Hirawati Deval; dr.hirawati@gmail.com
antiviral medication against JEV. The factors responsible for worse outcomes in JE may be amenable to timely treatment and can provide a framework for guiding decision-making, and targeted preventive strategies lead to improvement of patient prognosis as well as quality of life. Identifying these factors and rehabilitation needs in JE-endemic regions is imperative. Understanding the predictors of poor outcome in recovered paediatric patients with JE is necessary for planning the management effectively. In the present study, JE-associated long-term neurological and functional outcomes and the extent of reduced social participation among recovered children were determined. Patients’ demographic, clinical, biochemical and sequelae data were analysed for predictors of poor outcomes.

METHODS

Study design

The study was conducted retrospectively, involving a cohort of children (aged ≤16 years) hospitalised in the paediatric ward of Baba Raghav Das Medical College (BRDMC), Gorakhpur with laboratory-confirmed JE between January 2017 and December 2017. Patients with JE were screened from the AES line list generated by the Regional Medical Research Centre, Gorakhpur, UP of Indian Council of Medical Research. Details of the patients’ clinical history, routine biochemical findings and reports on aetiological investigations performed on cerebrospinal fluid/blood collected during discharge were also taken from the hospital records.

Case definitions

AES: a person of any age, at any time of the year, with an acute onset of fever and a change in mental status (including symptoms such as confusion, disorientation, coma or inability to talk) and/or new onset of seizures (excluding simple febrile seizure).8

JE-AES: a case that meets the clinical case definition of AES and laboratory confirmed as JE.8

Inclusion and exclusion criteria

Patients aged ≤16 years diagnosed with JE-AES from the AES line list were included in the study. Patients who denied consent, were not present at ≥2 times home visits, and those with no contact information or address were excluded in the study.

Patient follow-up, disability assessment and neurological examinations

The participating children were followed up between 6 and 12 months after discharge from the hospital (median duration 7 months, IQR 6–8). Their functional ability and social participation were assessed using standard tools, that is, the Liverpool Outcome Score (LOS 1–5)3 and Child and Adolescent Scale of Participation (CASP 2–5) scores.10 Motor and cranial neuron deficits were also recorded.

STATISTICAL ANALYSIS

Patients were divided into two groups based on LOS, that is, ‘poor outcome group’ (LOS=1, 2) and ‘better outcome group’ (LOS=3, 4 and 5). Two groups were compared for demographic, clinical, biochemical and sequelae data. Mean, median and SD were calculated for continuous variables. Normally distributed data were analysed using Student’s t-test or Mann-Whitney U tests, whichever was applicable. χ² test was used for categorical data. Statistically significant parameters whose p values were <0.05 in the univariate analysis were processed for predictive modelling using multivariate logistic regression analysis. Children who died post-discharge (scored 1 on LOS) were included in the outcome analysis. The Hosmer-Lemeshow goodness-of-fit test was used to assess fitness of predictive model. No missing data fields were found in variables. Sensitivity and specificity of the predictive model were determined, and performance of the model was assessed by constructing receiver operating characteristic curve. Area under the curve was determined. STATA V.13 software (StataCorp, College Station, Texas, USA) was used for all statistical analyses.

Patient and public involvement

Patients or the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

RESULTS

Patient characteristics

A total of 262 paediatric JE cases were hospitalised during 2017, of which 66 (25.2%) died during acute hospitalisation. Among the 196 (74.8%) discharged patients, 23 (11.7%) children died after hospital discharge (figure 1) due to severe complications (scored 1 on LOS). A total of 126 of 196 (64.3%) patients who fulfilled the inclusion criteria were assessed further; the median age was 7.5 years (range: 1.5–15 years), and 74 (58.73%) were male. The median duration between hospitalisation date (onset date) and follow-up/assessment date was 7 months (IQR 6–8).

Extent of disability, social behaviour and neurological findings

A total of 94 of 149 (63.08%) children developed neurological sequelae (scored 2–4 on LOS), while 32 (21.5%) recovered completely (scored 5 on LOS) (table 1). Age-expected social participation was compromised in 90 of 118 children (scored 2–4 on CASP) (table 1). Behavioural abnormality and aggressiveness were the most prominent features of neurological sequelae documented in 74.6% of children (table 2). Excessive salivation (16.7%) and squinting (26.9%) with weak eyesight (9.35%) and intermittent headache (10.1%) were also documented prominently (table 2). Motor examinations observed monoparesis in 5.5% children, while hemiparesis and quadripareisis were observed in 4% and 1.6% children, respectively (table 2).
Predictors of a poor outcome

Of the surviving patients, 113 (75.8%) had a better outcome (LOS score 3–5) and 36 (24.2%) had a poor outcome (LOS score 1–2). Patients who died post-hospital discharge scored 1 on LOS (table 1). Both poor and better outcome groups were compared for predictors of the outcome. There were no missing data for imputation. In the univariate analysis, non-immunisation against JE (p<0.001), malnutrition (measured as per WHO standards by measuring weight for height, weight for age, height for age and body mass index (BMI))11 (p=0.027), requirement of endotracheal intubation (p=0.013), inotrope support (p=0.013), Glasgow Coma Score (GCS) less than and equal to 8 (p=0.001), vomiting (p=0.009), altered sensorium (defined as limitations in the brain’s ability to receive, process or interpret the sensory information12 and detected using GCS) (p=0.006), multiple episodes (>1) of seizures (p=0.013), unconsciousness (p=0.001), extensor plantar (p=0.016), hypernatraemia (serum sodium >145 mmol/L) (p=0.019), hypotension (p=0.02) and anaemia (haemoglobin <80 g/L) (p=0.007) were found to be significantly associated with worst outcomes (table 3). All these parameters were taken to the predictive model by the multivariate logistic regression analysis. In the multivariate logistic regression analysis, a combination of parameters, JE unvaccinated status (OR: 61.02, 95% CI (14.10 to 264); p<0.001), low GCS at admission (≤8) (OR: 8.62, 95% CI (1.3 to 57.1); p=0.026), malnutrition (OR: 13.56, 95% CI (2.76 to 66.46); p=0.001) and requirement of endotracheal intubation (OR: 5.43, 95% CI (1.21 to 24.43); p=0.027) statistically significantly predicted a poor outcome (table 4) with 78% sensitivity and 94.6% specificity (table 5). The goodness-of-fit test showed that the model fit well ($\chi^2=3.13$, p=0.988), and the area under the receiver operating characteristic curve was 0.950 (figure 2).

Table 1  Liverpool Outcome Score (LOS) and Child and Adolescent Scale of Participation (CASP) scores obtained by patients and their interpretation

| LOS (N=14) | Score | No of patients (%) | Score interpretation | CASP (N=118) | Score | No of patients (%) | Score interpretation |
|------------|-------|--------------------|---------------------|-------------|-------|--------------------|---------------------|
| 1          | 23 (15.4) | Death            | –                   | –           | –     | –                   | –                   |
| 2          | 13 (8.7)  | Severe sequelae, impairing function sufficient to make patient dependent | 2 | 14 (11.9) | Unable to participate |
| 3          | 27 (18.1) | Moderate sequelae mildly affecting function, probably compatible with independent living | 3 | 26 (22) | Very limited participation |
| 4          | 54 (36.2) | Minor sequelae with no effect or only minor effect on physical function, or personality change, or on medication | 4 | 50 (42.4) | Somewhat limited participation |
| 5          | 32 (21.5) | Full recovery     | 5 | 28 (23.7) | Age-expected participation |
This predictive model have four effects: JE unvaccinated status (unvac), GCS ≤ 8 (gcs), malnutrition (mal) and endotracheal intubation (intub). The goodness-of-fit test suggests there are no gross deficiencies with the model. The small p value (<0.0001) for the logistic regression $\chi^2$ statistic implies that one or more effects in the model are important for predicting the probability of a poor outcome. The tests for parameters suggest that each effect in the model is significant at the 0.05 level (p<0.05). The equation for the given logistic regression predictive model is as follows:

$$\text{Log}(p^*/1-p^*) = -8.57 + 2.60\text{mal} + 2.15\text{gcs} + 4.11\text{unvac} + 1.69\text{intub}$$

Where $p^*$ = estimated probability of a poor outcome.

### DISCUSSION

In this study, we assessed the outcome among paediatric JE survivors after 6–12 months of hospital discharge. The aims of this study were to determine the extent of functional and social disabilities among children hospitalised with JE and to determine the factors that might be associated

---

Table 3  Univariate analysis of demographic characteristics, clinical signs, symptoms and complications (n=149)

| Characteristics                              | Poor outcome group (LOS=1/2) N=36 (%) | Better outcome group (LOS=3/4/5) N=113 (%) | $\chi^2$ | P value |
|----------------------------------------------|---------------------------------------|---------------------------------------------|---------|---------|
| Mean age                                     | 6.5 years                             | 6.9 years                                   | –       | –       |
| Gender                                       |                                       |                                             | 2.17    | 0.14    |
| Male                                         | 15 (41.7)                             | 63 (55.7)                                   |         |         |
| Female                                       | 21 (58.3)                             | 50 (44.24)                                  |         |         |
| Locality                                     |                                       |                                             |         |         |
| Rural                                        | 35 (97.2)                             | 107 (94.7)                                  |         |         |
| Urban                                        | 1 (2.8)                               | 6 (5.3)                                     |         |         |
| Occupation of parents/guardian               |                                       |                                             | 0.0039  | 0.95    |
| Daily wage labourer                          | 26 (72.2)                             | 81 (71.7)                                   |         |         |
| Other                                        | 10 (27.8)                             | 32 (28.3)                                   |         |         |
| JE unvaccinated status                       | 13 (36.1)                             | 19 (16.8)                                   | 23.31   | <0.001  |
| Required hospitalisation for more than 15 days| 16 (44.4)                             | 10 (8.84)                                   | 3.5152  | 0.061   |
| Malnutrition                                 | 33 (91.7)                             | 62 (54.9)                                   | 4.87    | 0.027   |
| Fever onset for >7 days                      | 16 (44.4)                             | 59 (52.2)                                   | 0.667   | 0.41    |
| High-grade fever (>38°C)                     | 21 (58.3)                             | 73 (64.6)                                   | 0.46    | 0.49    |
| Requirement of endotracheal intubation       | 9 (25)                                | 16 (14.15)                                  | 6.17    | 0.013   |
| Patient on anticonvulsant                    | 31 (86.1)                             | 93 (82.3)                                   | 0.209   | 0.647   |
| Patient on inotropes (dopamine/dobutamine)   | 18 (50)                               | 60 (53.1)                                   | 6.22    | 0.013   |
| Vomiting                                     | 18 (50)                               | 65 (57.5)                                   | 6.79    | 0.009   |
| Headache                                     | 6 (16.6)                              | 22 (19.5)                                   | 0.85    | 0.36    |
| Altered sensorium                            | 30 (83.3)                             | 81 (71.7)                                   | 7.56    | 0.006   |
| Multiple seizures (>1)                       | 25 (69.4)                             | 78 (69)                                     | 6.22    | 0.013   |
| Rolling of eyeballs                          | 26 (72.2)                             | 82 (72.6)                                   | 3.70    | 0.054   |
| Hypertonia                                   | 25 (69.4)                             | 72 (63.7)                                   | 0.39    | 0.53    |
| Extensor plantar                             | 28 (77.8)                             | 74 (65.5)                                   | 5.79    | 0.016   |
| Hypotension (SBP <90 mm Hg/DBP <60 mm Hg)    | 15 (41.7)                             | 68 (60.2)                                   | 5.45    | 0.02    |
| Glasgow Coma Score ≤8                        | 34 (94.4)                             | 75 (66.4)                                   | 10.24   | 0.001   |
| Unconsciousness                              | 7 (19.4)                              | 12 (10.6)                                   | 10.15   | 0.001   |
| Anaemia (Hb ≤80 g/L)                         | 10 (27.8)                             | 11 (9.7)                                    | 7.34    | 0.007   |
| Hypernatraemia (Na >145 mmol/L)              | 7 (19.4)                              | 7 (6.2)                                     | 5.46    | 0.019   |
| Alkaline phosphatase >147 IU/L               | 11 (30.5)                             | 55 (48.7)                                   | 1.4111  | 0.235   |
| Metabolic acidosis (pH <7.3)                 | 7 (19.4)                              | 18 (15.9)                                   | 5.96    | 0.056   |

DBP, diastolic blood pressure; Hb, haemoglobin; JE, Japanese encephalitis; LOS, Liverpool Outcome Score; Na, sodium; SBP, systolic blood pressure.
with the poor outcome. Our results showed that 63.08% (N=94) of children developed neurological sequelae at different levels of severity, and 15.4% (N=23) of children died after hospital discharge at home. Among 94 children, 13 (8.7%) were found severely disabled at the time of follow-up, 27 (18.1%) were found moderately disabled and 54 (36.2%) had mild neurological sequelae mostly in the form of behavioural changes and aggressiveness. In addition, reduced social participation at home/school/community was observed in 76.2% (N=90) of children. Disabled patients who were further assessed for motor and cranial deficits showed gross motor involvement in the form of quadriparesis (1.6%), hemiparesis (4%) and monoparesis (5.5%). Behavioural abnormalities were the most frequently observed cognitive (cortical) symptoms reported in 74.6% (n=94) of patients. Squinting (one or both eyes) and excessive salivation were other most prominent cranial nerve symptoms observed in 26.9% (n=34) and 16.7% (n=21) of patients, respectively. The reason behind hypersalivation/excessive salivation in these patients was not studied; this might be due to neurological impairment or could be due to endotracheal intubation as patients in intubation for more than 48 hours could have long-term swallowing/oral intake difficulty.

Previous studies from China, Vietnam, Cambodia, Indonesia, Malaysia, Nepal and India determined the extent of disability among JE survivors and reported varied estimates of disability that range from 50% to 70% among paediatric JE survivors. Nevertheless, the data from this study and other previous studies showed significant burden of JE in the form of disability. In our study, 32 (21.5%) children were found fully recovered and 28 (23.7%) children had age-expected social participation. Previous studies demonstrated that most changes (ie, improvement or deterioration) in JE-infected children occur soon after hospital discharge. About 75% of patients assessed between 3 and 6 months after hospital discharge had an identical status when assessed again at a later time. Therefore, all children in this study were assessed at least 6 months after discharge from hospital to observe the long-term outcome. One or both parents of about 70% of children were daily wage labourers, which highlights the poor socioeconomic status of the family.

Another goal of this study was to determine the factors that might be associated with poor outcomes in JE survivors. We found that children who were non-vaccinated against JE had malnutrition, had low GCS (≤8) and required endotracheal intubation at the time of admission had a poor outcome after hospital discharge. As there are no specific antiviral medications for JE and symptomatic treatment is the only way to manage the severity caused by JE, this study shows the importance of JE vaccination. We suggest strengthening JE immunisation campaigns by creating awareness among communities and recommend checking of children at school entries for JE vaccination. Low GCS in patients objectively defines the extent of impaired consciousness among patients with brain injury or trauma. The adverse effects of low GCS among patients with encephalitis are recorded earlier and are a well-established marker for a poor outcome in JE.

Our study also observed a significant association of low GCS (≤8) with a poor outcome in JE. As per the WHO definition, malnutrition is defined as imbalances (deficiency/excess) in intake of nutrients by a person and it is measured by weight for height, height for age, weight for age and BMI. The current predictive model observed an association of malnutrition with a poor outcome, and previous studies also recorded the significant similar finding. Endotracheal intubation requirement is highly suggestive of severity in patients, and a previous study reported this as a significant predictor of mortality among patients with encephalitis. In the current study, we observed a significant association between requirement of endotracheal intubation and poor outcomes.

**Table 4** Multivariate logistic regression analysis of factors associated with poor outcome due to JE

| Variable                  | OR (95% CI)     | P value  |
|---------------------------|-----------------|----------|
| JE unvaccinated status    | 61.03 (14.1 to 264) | <0.001   |
| Malnutrition              | 13.56 (2.77 to 66.46) | 0.001 (<0.05) |
| Glasgow Coma Score ≤8    | 8.6 (1.3 to 57.1) | 0.026 (<0.05) |
| Requirement of intubation | 5.43 (1.20 to 24.44) | 0.027 (<0.05) |

JE, Japanese encephalitis.

**Table 5** Sensitivity and specificity of the logistic regression model

|                  | Sensitivity | Specificity | Positive predictive value | Negative predictive value |
|------------------|-------------|-------------|---------------------------|--------------------------|
|                  | 77.8%       | 94.6%       | 82.35%                    | 92.9%                    |
We additionally asked the disabled patients’ guardians about how frequently they take their child to rehabilitation centres of BRDMC, and most of the families complained that the rehabilitation centre (Child Rehabilitation Centre, BRDMC) is so distant that they cannot afford and manage to take their disabled child this far for therapy on a regular basis. This study highlighted the need to strengthen JE vaccination coverage, framing of policies for rehabilitation services for the disabled and interventional programs to improve nutritional status of children in JE-endemic regions. We observed squinting in a significant number of children (26.9%); hence, a thorough ophthalmological examination of patients with JE for any ophthalmic complications is recommended at discharge and follow-up.

There are some limitations of this study as this study was conducted at a single centre and with a limited sample size, though this is the only tertiary care centre that catered to patients from this region. Another limitation of this study is that responses to the questions might be influenced by the awareness and knowledge of parents. The investigators suspect that sometimes parents deny disclosing their child’s abnormalities because of fear of discrimination in the society. We managed to assess 76% of patients with JE discharged from hospital in a year and there is a possibility that results could have been varied if all had been assessed. A further prospective study is needed to determine whether proper management of prognostic factors in the present study, that is, low GCS, malnutrition and requirement of endotracheal intubation could improve the outcome in patients with JE.

Acknowledgements We are sincerely grateful for the support of the Baba Raghav Das Medical College, Gorakhpur and health officials (additional director of health, chief medical officers, medical officers at DH/CHC/PHC) of Gorakhpur and Basti division. In addition, we thank all the patients and their guardians for their participation in this study. We appreciate the support of Mr Asif Kavathekar, Deendayal Swamkar and other scientific and technical staff members of ICMR-Regional Medical Research Centre, Gorakhpur for this study.

Contributors Study concept and design—VPB, HD and NS. Data acquisition—NS, HD and VPB. Analysis and interpretation of data—RY, NS, AD and VPB. Drafting of the manuscript—NS, VPB, AD, HD and MM. Critical revision of the manuscript for important intellectual content—VPB, AD, MM, HD and RK. Statistical analysis—RY, NS and AD. Overall guarantor—HD, NS

Funding This study was supported by a grant from the Indian Council of Medical Research, New Delhi, India (grant number: BMS/TF/TRANS-NEURO/2014-3377/ JUL-2015/13/UP/GOVT).

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not required.

Ethics approval The ICMR-National Institute of Virology, Pune Institutional Human Ethics Committee approved this study (ref ID: NIV/IHEC/2016/0-310). Informed consent was obtained at follow-up from each child’s parent or legal guardian.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement No data are available.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: http://creativecommons.org/licenses/by-nc/4.0/.

ORCID iD Hirawati Deval http://orcid.org/0000-0003-4300-9956

REFERENCES
1 Campbell GL, Hills SL, Fischer M, et al. Estimated global incidence of Japanese encephalitis: a systematic review. Bull World Health Organ 2011;89:766–74.
2 Bevelacqua J, Dutta R, In W, et al. A comparison of clinical features of Japanese encephalitis virus infection in the adult and pediatric age group with acute encephalitis syndrome. J Clin Virol 2011;52:45–9.
3 Singh G, Agrawal N, Singh CM, et al. Time and place distribution of acute encephalitis syndrome (AES) Japanese encephalitis (JE) cases in Gorakhpur, Ind J Community Health 2013;25:66–73.
4 Kumar R, Joshi PL. A review of Japanese encephalitis in Uttar Pradesh, India. WHO South East Asia J Public Health 2012;1:374–95.
5 National Vector Borne Disease Control Programme. State wise number of AES/JE cases and deaths from 2013-2019. Available: https://nvlbdcp.gov.in/WriteReadData/8906ce-jaaes%20-casesNov2019.pdf [Accessed 01 Jan 2021].
6 Verma A, Tripathi P, Rai N, et al. Long-Term outcomes and socioeconomic impact of Japanese encephalitis and acute encephalitis syndrome in Uttar Pradesh, India. Int J Infect 2017;4:e15607.
7 Maha MS, Moniaka VA, Hills SL, et al. Outcome and extent of disability following Japanese encephalitis in Indonesian children. Int J Infect Dis 2009;13:e389–93.
8 Operational guidelines for national vector borne disease control program (NVBDCP), Ministry of health and family welfare, Govt of India, 2017. Available: https://nvlbdcp.gov.in/Doc/je-aes-aps [Accessed 12 Sep 2019].
9 Lewthwaite P, Begum A, Ooi MH, et al. Disability after encephalitis: development and validation of a new outcome score. Bull World Health Organ 2010;88:584–92.
10 Bedell G. Further validation of the child and adolescent scale of participation (CASP). Dev Neurorehabil 2009;12:342–51.
11 World Health Organisation. Malnutrition, 2019. Available: https://www.who.int/news-room/fact-sheets/detail/malnutrition [Accessed 26 May 2022].
12 Douglas VC, Joshipura SA. Altered mental status. Continuum 2011;17:967–83.
13 Tsai M-H, Ku S-C, Wang T-G, et al. Swallowing dysfunction following endotracheal intubation: age matters. Medicine (Baltimore) 2016;95:e5871.
14 Hofmeister J, Zaborek N, Thibeault SL. Postextubation dysphagia in pediatric populations: incidence, risk factors, and outcomes. J Pediatr 2019;211:126–33.
15 Ding D, Hong Z, Zhao S-J, et al. Long-term disability from acute childhood Japanese encephalitis in Shanghai, China. Am J Trop Med Hyg 2007;77:528–33.
16 Hills SL, Van Cuong N, Touch S, et al. Disability from Japanese encephalitis in Cambodia and Viet Nam. J Trop Pediatr 2011;57:241–4.
17 Ooi MH, Lewthwaite P, Lai BF, et al. The epidemiology, clinical features, and long-term prognosis of Japanese encephalitis in central Sarawak, Malaysia, 1997–2005. Clin Infect Dis 2008;47:458–68.
18 Kumar R, Mathur A, Singh KB, et al. Clinical sequelae of Japanese encephalitis in children. Indian J Med Res 1993;97:9–13.
19 Jain S, Iversion LM, Glasgow Coma Scale. In: StatPears [Internet]. Treasure Island, FL: StatPears Publishing, 2022. https://www.ncbi.nlm.nih.gov/books/NBK513298/.
20 Khandaker G, Jung J, Britton PN, et al. Disability after encephalitis in children: a systematic review and meta-analysis. Dev Med Child Neurol 2016;58:1108–15.
21 Misra UK, Kalita J, Srivastava M. Prognosis of Japanese encephalitis: a multivariate analysis. J Neurol Sci 1998;161:143–7.
22 Singh P, Bhattacharjee CS, Singh V, et al. Influence of malnutrition on adverse outcome in children with confirmed or probable viral encephalitis: a prospective observational study. Biomed Res Int 2015;2015:1–5.
23 Thakur KT, Motta M, Asemota AO, et al. Predictors of outcome in acute encephalitis. Neurology 2013;81:793–800.