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Original Article

Paediatrics Section

Post-COVID-19 Three-year Trends of Clinical Profile and Outcome of Infants (1-12 months) Hospitalised at the Paediatric Department of a Tertiary Care Teaching Hospital of Gujarat, Western India: A Retrospective Study

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ABSTRACT

Introduction: The post-neonatal period (1-12 months) also represents a critical vulnerability window in child health. Despite substantial global progress in reducing under-five mortality, infant hospitalisations beyond the neonatal period continue to pose considerable challenges, particularly in developing countries where 10-15% of hospitalised infants succumb to preventable conditions. Understanding the clinical profile, temporal trends, and outcomes of hospitalised infants is essential for both, clinicians as well as administrators or policymakers.

Aim: To study the 3-year trends of clinical profile and outcome of infants (beyond Neonatal Period) hospitalised at tertiary care teaching hospital after the end of the "Coronavirus Disease-2019 (COVID-19) pandemic".

Materials and Methods: This retrospective study was conducted at the Department of Paediatrics, Shree Krishna Hospital, Pramukhswami Medical College, Karamsad, Gujarat, India over three years (July 2022 to June 2025). All consecutive indoor infants aged 1-12 months during the study period were included. The demographic details and clinical details including outcome were retrieved from medical records and pertinent information collected using a predesigned, structured proforma. Data were analysed using appropriate descriptive and inferential statistical methods.

Results: A total of 177 infants were enrolled (Year-wise n=78, 76 and 23, respectively). The overall study cohort showed male predominance of 114 (64.4%). Respiratory infections emerged as the leading diagnosis in 60 (33.9%), followed by cardiovascular disorders 30 (16.9%). About 64 (36.2%) required Paediatric Intensive Care Unit (PICU) admission with critical illnesses. Successful discharge in 151 (85.3%) and mean±SD length of stay was 6.7±8.7 days. Significant relationship was found in trends for increasing prematurity (1.3% to 17.4%, p-value=0.002), declining immunisation completion (65.4% to 26.1%, p-value <0.001). Socio-economic status showed highly significant associations with both outcomes (p-value=0.003) and PICU admission (p-value <0.001).

Conclusion: Post-COVID-19 epidemic, 3-year trends showed the temporal trends of rising prematurity rates, declining immunisation rates, and persistent high Discharge Against Medical Advice (DAMA) rates. This study provides essential baseline data for designing evidence-based interventions at tertiary care settings that serve vulnerable populations.

Keywords: Low birth weight, Malnutrition, Prematurity, Post-COVID Era, Socio-economic determinants

INTRODUCTION

Apart from neonates, infants between 1-12 months are also vulnerable as far as mortality and morbidity are concerned as this phase is characterised by unique physiological, immunological, and developmental transitions which has significant influence on them [1]. Though there is trend in reduction of under-five mortality globally over the past three decades, hospitalisations beyond the neonatal period during infancy continue to pose considerable challenges to healthcare systems worldwide, with respiratory infections, gastroenteritis, and sepsis remaining the leading causes of admission across diverse geographic as well as socio-economic contexts [2].

Gujarat, despite being one of India's more economically developed states, continues to experience infant mortality rates above the national average, with rural areas showing particularly concerning trends in hospitalisation patterns and outcomes for infants beyond the neonatal period [3]. Understanding the clinical profile and outcomes of hospitalised infants beyond the neonatal period is essential for multiple stakeholders in the healthcare system. For clinicians, detailed knowledge of admission patterns, common diagnoses, and risk factors for adverse outcomes enables better triage, resource allocation, and clinical decision-making. Recent global events, including the COVID-19 pandemic, have highlighted the vulnerability of health systems and the disproportionate impact on infant health services [4,5]. The role of social determinants is of utmost importance to understand hospitalisation patterns in infants. The risk factors may include status of maternal education, household income, residence, access to clean water/sanitation and exposure to air pollution [6]. In the Indian context, additional factors such as caste, gender discrimination, and cultural practices significantly influence healthcare-seeking behaviour and outcomes for hospitalised infants.

The current study aimed to generate the comprehensive data on the clinical profile and outcome of infants beyond the neonatal period admitted to the only tertiary care teaching hospital of Anand district of Gujarat in subsequent three years once the COVID-19 epidemic declared over. By analysing three years of admission data, this research can contribute to understanding temporal trends, identifying high-risk groups, and informing evidence-based strategies for improving infant health outcomes in similar settings.

MATERIALS AND METHODS

This retrospective study conducted at the Department of Paediatrics, Shree Krishna Hospital, a tertiary care teaching hospital affiliated with Pramukhswami Medical College, Karamsad, Gujarat, India from July 2022 to December 2025. The data was retrieved from medical records after obtaining approval from ethics committee with waiver of consent (IEC/BU/165/Faculty/12/221/2025 dated 5th July 2025). The study included data from three years: July 2022 to June 2025. Year-wise (Year 1: July 2022-June 2023, Year 2: July 2023-June 2024 and Year 3: July 2024-June 2025) and overall, the data was analysed in December 2025.

All infants aged 1-12 months hospitalised either in the PICU or the paediatric ward during study period were included. None were excluded from the study.

Sample size: No formal calculated sample size but whatever numbers hospitalised in the paediatric department year-wise during study period was considered as study sample.

Study Procedure

The data was collected using a predesigned, structured proforma which included the following variables: Demographic details (age, sex, socio-economic status), clinical profile including weight, date of admission, place of admission (PICU/ward), duration of hospital stay, laboratory investigations, outcome {discharge, DAMA, referral or death}.

STATISTICAL ANALYSIS

Data was analysed using STATA 18. Descriptive statistics were used to summarise the data. Continuous variables were expressed as Mean±Standard Deviation (SD) or Median (Interquartile Range) as appropriate, while categorical variables were expressed as frequencies and percentages. Year-wise trends in demographics, clinical profile, and outcomes were depicted using line charts and box plots as appropriate. For studying the association between risk factors and outcomes, the Odds Ratio (OR) with 95% Confidence Interval (CI) was calculated. Chi-square test or Fisher's exact test was used to compare categorical variables. A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 177 infants were hospitalised during studied period of July 2022 to June 2025. Year-wise they were 78, 76 and 23 in first, second and third years, respectively. The overall mean±SD age was 5.22±3.11 months. The overall study cohort showed male predominance of 114 (64.4%) as well as 114 (64.4%) contributed from lower/lower-middle class. Year-wise further demographic and pertinent clinical details are as per [Table/Fig-1]. Year one showed the highest percentage of younger infants (1-3 months), overall male predominance, largest portion of hospitalised cohort belonged to the lower middle class/lower class, the mean±SD birth weight of infants, requirement of PICU admission, mean length of stay or outcome, if compared year-wise, there was no statistically significant difference. However, mean±SD gestational age at birth was statistically significant across the 3-years (p-value=0.039) with prematurity on rise in year-3. Also, immunisation completion rates showed a marked decline in Year 3 (p-value <0.001).

Reasons for hospitalisation or underlying diagnosis are as per [Table/Fig-2]. A highly significant trend was observed across periods (p-value <0.001) where respiratory conditions proportionately declined and haematological conditions increased. As in [Table/Fig-3], haemoglobin was measured in 159 infants (89.8% of total) with a mean of 9.51±1.75 g/dL but there was no statistically significant difference observed across the years. Other common laboratory parameters are shown in [Table/Fig-3] which was also statistically not significant.

The disease severity, age, vaccination and socio-economic status appeared to be more important determinants when risk analysis done. A clear inverse relationship was observed between age and PICU admission as the youngest infants (1-3 months) had the highest PICU admission rate 67 (37.9%). A significant association was observed between PICU admission and outcome (Fisher's exact test, p-value=0.001). Risk analysis revealed that PICU admission was a highly significant risk factor for poor outcome with an OR of 5.14 (95% CI: 2.08-12.66, p-value <0.001). [Table/Fig-4] shows incomplete vaccination was markedly higher in cardiovascular admissions 7.3% vs 32.4% whereas respiratory system involvement

Category	Subcategory	Year 1 (n=78)	Year 2 (n=76)	Year 3 (n=23)	p-values*	Overall n (%)
Age category (in months)	1-3	34 (43.6)	25 (32.9)	8 (34.8)	0.429	67 (37.9)
	4-6	23 (29.5)	24 (31.6)	5 (21.7)		52 (29.4)
	7-9	13 (16.7)	15 (19.7)	8 (34.8)		36 (20.3)
	10-12	8 (10.3)	12 (15.8)	2 (8.7)		22 (12.4)
Mean±SD age (in months)		5.35±3.13	4.77±3.04	5.64±3.16	0.211	5.22±3.11
Sex	Male	52 (66.7)	50 (65.8)	12 (52.2)	0.419	114 (64.4)
	Female	26 (33.3)	26 (34.2)	11 (47.8)		63 (35.6)
Socio-economic status*	Lower middle class	28 (35.9)	22 (28.9)	12 (52.2)	0.503	62 (35)
	Lower class	21 (26.9)	26 (34.2)	5 (21.7)		52 (29.4)
	Upper middle class	19 (24.4)	20 (26.3)	5 (21.7)		44 (24.9)
	Upper class	10 (12.8)	8 (10.5)	1 (4.3)		19 (10.7)
Low birth weight (<2.5 kg)		25 (32.1)	29 (38.2)	12 (52.2)	0.374	66 (37.3)
Mean±SD Kg of weight at birth		2.73±0.46	2.67±0.49	2.5±0.58	0.246	2.68±0.49
Preterm		1 (1.3)	5 (6.6)	4 (17.4)	0.002	10 (5.7)
Mean±SD of gestational age (in weeks) at birth		37.86±1.24	37.46±1.84	36.8±2.57	0.039	37.6±1.8
Mean±SD Kg of weight on admission		5.42±2.13	5.57±2.23	5.16±2.21	0.607	5.42±2.16
Positive history of NICU admission		19 (24.4)	14 (18.4)	7 (30.4)	0.303	40 (22.6)
Requirement of PICU admission		28 (35.9)	32 (42.1)	4 (17.4)	0.097	64 (36.2)
Complete immunisation		51 (65.4)	52 (68.4)	6 (26.1)	<0.001	109 (61.2)
Outcome	Discharged	67 (85.9)	65 (85.5)	19 (82.6)	0.150	151 (85.3)
	DAMA	11 (14.1)	11 (14.5)	4 (17.4)		26 (14.7)
Length of stay (Days) (Mean±SD)		6.1±7.7	7.7±9.9	5.9±7.3	0.346	6.7±8.7

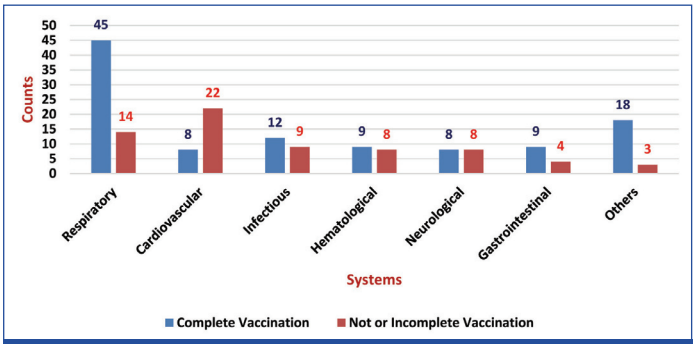
[Table/Fig-1]: Trends of demographic and clinical parameters year-wise.
*As per modified Kuppuswami classification

Diagnosis group	Year 1 (n=78) (%)	Year 2 (n=76) (%)	Year 3 (n=23) (%)	p-value	Overall n (%)
Respiratory infections	32 (40.9)	25 (32.9)	2 (8.8)		59 (33.3)
Cardiovascular	19 (24.4)	8 (10.5)	3 (13.1)		30 (16.9)
Infectious diseases	8 (10.3)	11 (14.5)	2 (8.8)		21 (11.9)
Haematological	5 (6.4)	6 (7.9)	6 (26.1)		17 (9.6)
Neurological	6 (7.7)	7 (9.2)	3 (13.1)		16 (9)
GI disorders	5 (6.4)	7 (9.2)	1 (4.3)		13 (7.4)
Others	1 (1.3)	6 (7.9)	1 (4.3)		8 (4.5)
Metabolic/endocrine	0	3 (3.9)	1 (4.3)	<0.001	4 (2.3)
Urinary tract/renal	0	2 (2.6)	1 (4.3)		3 (1.7)
Nutritional	1 (1.3)	1 (1.4)	0		2 (1.1)
Behavioural/Functional	0	0	1 (4.3)		1 (0.6)
Dermatological	0	0	1 (4.3)		1 (0.6)
Developmental disorders	1 (1.3)	0	0		1 (0.6)
Environmental	0	0	1 (4.3)		1 (0.6)
Total	78 (100)	76 (100)	23 (100)		177 (100)

[Table/Fig-2]: Trends of diagnosis/predominant system involvement year-wise.

Laboratory tests	Year 1 Mean±SD	Year 2 Mean±SD	Year 3 Mean±SD	p-value	Overall Mean±SD
Haemoglobin in g/dL, (n=159)	9.72±1.63	9.29±1.87	9.48±1.76	0.462	9.51±1.75
Total leucocyte count in mm^3, (n=119)	17,301±11,814	23,916±62,868	14,002±5,763	0.10	17,193±35,111
Platelet counts in mm^3, n=116	352,151±242,814	234,888±303,952	422,521±201,101	0.034	327,285±262,806
C-reactive protein mg/dL, n=85	12.56±21.50	17.93±26.17	17.98±11.84	0.003	15.03±21.88

[Table/Fig-3]: Trends of common laboratory tests year-wise.



[Table/Fig-4]: System-wise proportion of complete and not or incomplete vaccination.

had highly good numbers of complete vaccination status as per their age as compared to incomplete status (41.3% vs 20.6%). Lower middle/Lower SE class infants had the highest PICU admissions (63.2%, n=72/114). History of NICU admissions was also an important risk factor of PICU admission as statistically significant difference found between the groups (p=0.044).

DISCUSSION

The present study exclusively enrolled infants aged 1-12 months, with a mean±SD age of 5.22±3.11 months. This age distribution reflects the vulnerability window for severe paediatric illness. The concentration of cases in the 2-6 month age range reflects probably the immunological transition period when maternal antibodies wane and infant immunity remain immature, as demonstrated by Zimmermann P and Curtis N [7]. Even Killien EY et al., conducted epidemiological studies from the United States examining paediatric intensive care admissions from 2001-2019 and found that infants under 12 months consistently comprised the highest proportion of critical care admissions, representing approximately 40-45% of all paediatric ICU cases [8].

During COVID-19 epidemic, there was significant decrease in social gatherings. However, once the restriction was lifted back and epidemic declared over there was normalisation of all routine activities gradually. However, it was the author's experience that there was sudden increase in admissions of infants in the department as compared to previous years. The 3rd year of studied period showed significant decrease in admissions, probably due to decrease in births of newborns in the region or less numbers of newborns now requiring NICU admissions or less numbers are referred to this tertiary care hospital as cost of treatment in PICU was not covered under any scheme.

In the present study, the male predominance (1.8:1) was noted which represented a striking gender disparity that warrants careful consideration. This finding exceeds the typical male: female admission ratios reported in most paediatric studies, which generally range from 1.2:1 to 1.5:1, as documented by Kannan C and Iyengar K [9]. Multiple hypotheses may explain this observation but further discussion is beyond the scope. Approximately, 35-40% of study cohort had birth weights below 2.5 kg, qualifying as LBW. This finding carries enormous implications for subsequent growth and development. Low birth weight represents one of the most powerful predictors of infant morbidity and mortality globally. Christian P et al., established through multiple longitudinal studies that LBW infants face elevated risks of failure to thrive, developmental delays, impaired immune function, and chronic diseases, including diabetes and cardiovascular disease in adulthood [10]. The socio-economic profile of the present cohort reveals profound disadvantage as 64.4% of families belonged to lower or lower-middle socio-economic classes. These socio-economic characteristics are inextricably linked to the health outcomes observed in current study and literature also says that socio-economic status as one of the most powerful determinants of child health outcomes. Crear-Perry J et al., quantified that infants born to mothers in the lowest socio-economic quintile face 2.5-3.0 times higher mortality risk compared to highest quintile, even within the same geographic region [11]. This striking disparity suggests that lower socio-economic groups present with more severe illness, likely due to delayed healthcare seeking, inadequate preventive care, and poorer baseline nutrition. One-third of current study cohort (64 patients, 36.2%) required PICU admission during hospitalisation, indicating high illness severity and substantial critical care resource utilisation. This PICU admission rate substantially exceeds most reported paediatric hospital-based studies. Killien EY et al., documented that ICU admissions comprised approximately 8-12% of all paediatric hospitalisations [8]. ...Amare AT et al., conducted a 2023 cross-sectional study from a resource-limited setting examining paediatric ICU outcomes and documented 41.7% mortality among 396 PICU patients, substantially higher than high-income country benchmarks of 4-8% [12]. While the present study did not explicitly report ICU-specific mortality, the overall DAMA rate of 14.7% (26 patients) among ICU patients suggests concerning outcomes. Hwang SW et al., showed that DAMA in critically-ill patients typically portends very poor outcomes, with mortality rates exceeding 50-70% in most series [13]. The specific indications for PICU admission in present cohort encompassed respiratory conditions, septic shock, Multi-Organ Dysfunction (MODS), postoperative cardiac monitoring and status epilepticus. This diagnostic distribution aligns with international paediatric ICU literature. Typpo KV et al., also identified respiratory failure as the most common indication for paediatric ICU admission, followed by shock, postoperative care, and neurological

emergencies [14]. Respiratory conditions/infections emerged as the dominant diagnosis category in the present study cohort, accounting for 60 of 177 cases (33.9%) especially with increased preterm in later year, establishing them as the leading cause of infant hospitalisation in spite of complete vaccination status in earlier years underscores the severity and resource intensity of managing these conditions. The striking feature of incomplete immunisation seen in Congenital Heart Disease (CHD), which was the second most common diagnosis affecting 30 (16.95%) patients. The probable reason for such higher number of CHDs in this study was that the study setting had well developed paediatric cardiac centre. In the present study, anaemia burden was also quite high and it was 89.3% (n=142/159) of varying severity among tested patients with moderate to severe anaemia in 60.4% (n=96/159). Bharati P et al., and Kapil U et al., documented anaemia prevalence ranging from 65-85% among hospitalised infants in India, with mean haemoglobin values of 9.0-10.5 g/dL [15,16]. The most concerning findings in this study was the DAMA rate of 14.7% (26 patients), with an increasing trend 14.1% → 14.5% → 17.3% which reflected probably growing financial pressures on families, increasing healthcare costs, or deteriorating provider-family communication after COVID-19 epidemic but the DAMA rate of 14.7% was higher than the previous published study from Riyadh [17]. Albalawi M et al., conducted a 2024 comprehensive 10-year retrospective analysis examining paediatric DAMA in a tertiary care centre and documented a DAMA rate of 0.4%, with significant predictors including age, presence of a chronic illness or severe baseline condition and history of previous DAMA [17]. In the present study, the mean±SD length of stay was 6.7±8.7 days with a range of 0-63 days. This distribution demonstrates typical right-skewing, with most infants requiring brief admissions but a subset experiencing prolonged hospitalisations. In current study cohort, review of the longest-stay cases revealed complex CHD awaiting surgery, severe PEM requiring nutritional rehabilitation, CNS infections with complications, and chronic conditions, including subdural empyema status-post neurosurgery. The correlation between increasing DAMA rate and changing length of stay suggests possible causal relationships; longer required hospitalisations may trigger more DAMAs due to accumulating costs and family pressures.

Limitation(s)

The main limitation of this study was retrospective and record-based study and its result cannot be generalised as it is single centre. Also, causes of DAMA not evaluated extensively.

CONCLUSION(S)

This study provides first regional data of infants hospitalised beyond neonatal period subsequent to the end of COVID-19 pandemic at the tertiary care teaching hospital of the Anand District which is the only medical college of this district. The present study documents a paediatric population facing enormous health challenges, with respiratory infections, malnutrition, anaemia, CHD, and socio-economic disadvantage combining to create significant infant morbidity. The high-quality data captured in this study provide evidences for regional intervention or policy advocacy to improve outcomes for the most vulnerable infants. This alarming decline in complete immunisation in period of three years represents a critical public health concern requiring immediate attention and intervention strategies.

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