BMJ Open

Epidemiological trends of febrile infants presenting to the Paediatric Emergency department, in a tertiary care hospital, Karachi, Pakistan: a retrospective review

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To cite: Bushra Q, Fatima S, Hameed A, *et al*. Epidemiological trends of febrile infants presenting to the Paediatric Emergency department, in a tertiary care hospital, Karachi, Pakistan: a retrospective review. *BMJ Open* 2024;**14**:e076611. doi:10.1136/bmjopen-2023-076611

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (https://doi.org/10.1136/bmjopen-2023-076611).

Received 12 June 2023
Accepted 06 August 2024

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ABSTRACT

Background Understanding the epidemiological patterns of febrile infants can offer valuable insights for optimising management strategies and developing quality improvement initiatives, aiming to improve healthcare delivery in high-volume, low-resource emergency departments (EDs).

Objectives To characterise the epidemiology of febrile infants presenting to the paediatric ED of a tertiary care hospital.

Methods A retrospective chart review of medical records was performed for febrile infants ≤1 year old, at paediatric ED, Indus Hospital and Health Network (IHHN), Karachi, Pakistan (1 January 2020–31 December 2020).

Results There were a total of 2311 patients in the study, with a male-to-female ratio of 1.4:1. The mean age of presentation was 4.9±2.7 months. Cough (n=1002, 43.2%) was the most frequent presenting symptom. The most common provisional ED diagnosis in ≤1 month of age was sepsis (n=98, 51%), bronchopneumonia (n=138, 28.6%) in 1.1–3 and 3.1–6 months (n=176, 36.45%); and upper respiratory tract illness (n=206, 47.4%) in 6.1–12 months of age. Age was significantly associated with provisional ED diagnosis and outcomes (p<0.001). Of 175 ED admissions (n=47, 26.8%), patients were discharged with a hospital diagnosis of bronchopneumonia and (n=27, 15.4) of sepsis. The infant mortality rate was 3/1000 live births.

Conclusions This study is the first of its kind to explore the epidemiology of febrile infants in Pakistan, highlighting the burden and severity of respiratory illnesses and sepsis. It underscores the challenges of resource-limited settings, failing to meet the need for admission of febrile infants presenting to ED, IHHN. Moreover, it has highlighted the necessity to optimise the existing triage systems to effectively allocate resources and manage high patient volumes in low-resource EDs.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The substantial sample size offers an opportunity to gauge the epidemiology of febrile infants.
⇒ The presence of refer-outs, leave against medical advice and discharge on request has limited the depth of analysis.
⇒ The retrospective, single-centre nature of the study, has limited the generalisability of the results.
⇒ The possibility of information bias cannot be ignored, as data were extracted retrospectively from health management information systems.

INTRODUCTION

Children comprise around 27% of the world's population.[1] In 2015, the United Nations established Millennium Development Goals; one of which aimed to decrease under-5 mortality by two-thirds. Presently, this has reduced by more than half, decreasing from 90 to 26.7/1000 live births.[2 3] Infant mortality is a key indicator of a society's health systems.[2 4] According to the United Nations Children's Fund (UNICEF), Pakistan has the worst infant mortality rate (IMR) of 54.65/1000 live births in the world[3] and is considered the riskiest place to be born.[5] Following Pakistan, Afghanistan (46/1000), Yemen (42.2/1000) and India (27.7/1000 live births) also report high IMR.[6 7] In Pakistan, child mortality stems from various factors, that is, premature births, delivery complications, inadequate vaccination, nutrition and breast feeding, communicable diseases and socioeconomic factors, that is, low education, hygiene and poverty, and fragile health infrastructure.[8 9]

In this context, fever, a primary clinical indicator of infection, constitutes 10%–20% of emergency department (ED) visits. It may be secondary to bacterial, viral or noninfectious aetiology.[10–12] In the majority of septic children, fever[13–15] is the leading presenting complaint; with hypothermia reported in only 20%.[16] Almost 47% of acute febrile illnesses are attributed to sepsis.[17] Globally, sepsis is the leading cause of death among children,

attributing to 10%–20% deaths.[18] Haji *et al* reported 17.7% febrile infants ≤3 months present to the ED with serious bacterial infections (SBIs) (ie, pneumonia, meningitis, urinary tract infection (UTI) and bacteraemia).[8] It is challenging to differentiate between SBI and mild viral illness, and fever may be the only ominous sign at ≤3 months of age.[8 19] There is approximately 10% incidence of SBI in febrile infants aged ≤3 months; increasing up to 13% in ≤1 month of age.[20] In a study by Gowa *et al* (n=4030, 23.8%) of neonates presented in ED with sepsis in Karachi, Pakistan.[21]

The Indus Hospital and Health Network (IHHN) is a 150-bed state-of-the-art, philanthropic tertiary care providing free-of-cost, quality patient care, to the underprivileged, located in Karachi, a city with a population of 16 093 786.[22] IHHN serves the city's most populous and economically deprived area, the Korangi district, which has a population of 2 457 019.[23] According to a survey conducted in Pakistan, only 21% of patients opt for public sector hospitals while 79% prefer private sector hospitals. This significant disparity in utilisation is primarily due to the dilapidated conditions, dissatisfaction and lack of access to quality care.[24] In contrast, IHHN stands out as a beacon of hope, offering free, high-quality care services to the underprivileged. Within the paediatric ED of IHHN, over 400 patients are attended daily with an estimated >800 annual deaths as per hospital records. The paediatric ED houses 1 see and treat clinic, 10 general emergencies, 1 isolation and 4 beds for oncological emergencies. As a standard; on ED presentation, patients are triaged with Manchester triage system (MTS)[25] and Paediatric Early Warning Score (PEWS)[26] in the triage bay.

Through investigating the epidemiological characteristics of febrile infants presenting to the paediatric ED, IHHN, Karachi, Pakistan, we hope to understand the burden of disease and patient outcomes. We aim to identify systemic gaps in triage and continuity of care. This understanding shall deliver evidence-based information to improve practices and make recommendations for collated systems. To the authors' best knowledge, there is no existing literature from Pakistan and the surrounding region, and hope this study will provide a deep insight into the epidemiological landscape of febrile infants presenting in high-volume, resource-limited EDs.

OBJECTIVE

The primary objective of this study was to investigate the epidemiological patterns of febrile infants presenting to the paediatric ED of IHHN, Karachi, Pakistan.

METHODOLOGY

Study design and setting

Data collection method

A retrospective cross-sectional study was conducted at the Paediatric ED IHHN, Karachi Pakistan (1 January 2020–31 December 2020). All patients were triaged on ED presentation via the Manchester triage system (MTS) as follows {P1(immediate), P2(very urgent) P3(urgent), P4 (standard) and P5 (non-urgent)}[25] along with PEWS.[26] The study included all infants ≤1 year of age who presented to paediatric ED at any time of the day; with fever defined as rectal temperature ≥38°C, as recorded once during paediatric triage.[27] Patients were managed according to standard protocols of ED, and IHHN, and clinical decisions were undertaken by board-certified EM physicians with ≥2 years experience.

Data of patient demographics, including medical record number, gender, age at presentation, triage acuity, presenting complaints, provisional ED diagnosis (ie, preliminary ED diagnosis made by EM physician based on the available information and investigations) and hospital discharge diagnosis from inpatient, were recorded. ED outcomes (ie, discharged from ED, expired in ED, admitted from ED in inpatient [(high-dependency unit/paediatric intensive care unit (PICU)/neonatal intensive care unit (NICU)], discharge on request (DOR), that is, patients' request to be released from the hospital before the completion of medical treatment, leave against medical advice (LAMA), that is, patients leave the hospital against medical advice, under the decision of legal guardian/patient and refer out after initial stabilisation to other hospitals, due to in availability of beds at IHHN, was documented.

Patients were diagnosed with bronchiolitis, based on clinical symptoms of lower respiratory tract infection and X-ray findings suggestive of bilateral lung hyperinflation.[28] Patients were diagnosed with bronchopneumonia, based on the presence of signs of respiratory distress, that is, tachypnoea, chest retractions and crackles on auscultation, supplemented with X-ray showing bilateral patchy lung infiltrates.[29] Patients were diagnosed with acute gastroenteritis (AGE), based on the history of loose watery/mucoid stools with/without vomiting, fever along with clinical signs of dehydration.[30] Patients were provisionally diagnosed with enteric fever based on fever, diffuse abdominal pain, and tenderness, diarrhoeas, skin changes (rose spot; salmon-coloured, blanching, truncal, maculopapular rash), and relative bradycardia.[31] Patients were diagnosed with UTI based on a history of fever ≥38°C, as recorded on rectal temperature and a urine analysis report suggestive of infection.[32] Patients were diagnosed in ED as suspected sepsis (ie, the presence of risk factors of sepsis in the infant, regardless of the presence or absence of clinical symptoms), clinical sepsis (ie, suggestive laboratory and clinical findings but failure to depict causative organism) and proven sepsis (ie, the presence of laboratory, clinical findings and presence of the causative organism in cultures).[33] Since this study was conducted during the first and second wave of COVID-19, all patients admitted from ED, underwent PCR for COVID-19.

Data were extracted retrospectively from electronic health management information systems (HMIS), deidentified and coded by a data analyst. Data were recorded on

a predesigned performa and entered into a secure electronic database. A manual chart review was conducted by the principal investigator and team. Data confidentiality was ensured. Due to the retrospective nature of the study, convenience sampling was used to extract data. Data were entered and analysed on IBM SPSS V.21. Descriptive statistics were used to report continuous variables (mean±SD and median) and IQR (as appropriate). Categorical variables were reported as frequencies and percentages. To establish an association between variables χ^2 or Fisher's exact test was executed as appropriate. A p≤0.05 was considered significant.

Patient and public involvement

None.

RESULTS

Data from 2311 patients were reviewed. There were (n=1364, 59%) males and (n=947, 41%) females. The mean age of infants was 4.9±2.7 months (1 day to 12 months). Most of the infants were triaged in P2 acuity (n=1659, 71.8%). Most children belonged to the age group of 6.1–12 months (n=755, 32.7%) with cough as the most frequent symptom (n=1002, 43.2%) (table 1). The most common provisional ED diagnosis in infants of ≤1 month was sepsis (n=98, 51%), followed by bronchopneumonia (n=36, 7.5%). Among 1.1–3 months and 3.1–6 months, bronchopneumonia was the most frequent provisional ED diagnosis; (n=138, 28.6%) and (n=176, 36.4%), respectively; followed by URTI (n=64, 14.7%) and (n=146, 33.6%), respectively. However, at 6.1–12 months of age, URTI (n=206, 47.4%) was most frequent followed by bronchopneumonia (n=133, 27.5%). Our study revealed that AGE (n=124, 39%), enteric fever (n=19, 52.8%) and UTI (n=5, 45.5%) predominantly occurred in the oldest age group as compared with other groups (table 2). The age of the children was highly significantly associated with provisional ED diagnosis and outcome (p<0.001) (table 2).

Most infants were admitted from ED with provisional ED diagnosis of bronchopneumonia (n=47, 26.9%) and sepsis (n=40, 22.9%); along with being the most common reason for referral for admission after stabilisation (table 3) (p<0.001). ED, IHHN admitted (n=175, 7.6%) and (n=819, 35.4%) patients were referred out to other tertiary care centres after initial stabilisation; due to unavailability of beds. The most common provisional ED diagnosis for admission in paediatric HDU was bronchopneumonia (n=32, 29.6%), followed by sepsis (n=14, 13%). Similarly, (n=14, 31.7%) PICU admissions were secondary to bronchopneumonia, followed by sepsis (n=11, 24.4%). In NICU, sepsis remained the most prevalent admitting diagnosis (n=15, 71.4%) (table 4) (p<0.001).

Most provisional ED diagnoses, attended in P1 acuity, were bronchopneumonia (n=75, 35.9%), sepsis (n=29, 13.9%) and URTI (n=17, 8.1%); and in P2 acuity were bronchopneumonia (n=371, 22.4%), URTI (n=331, 20%) and sepsis (n=140, 8.4%). On the other hand, the majority of the cases of AGE were dealt with in P3 acuity (n=113, 31.9%), followed by URTI (n=60, 16.9%). While in P4 acuity, URTI (n=27, 32.1%) was the most frequent (p<0.001) (table 5).

For 175 admissions made from ED; (n=47, 26.8%) infants were discharged with a diagnosis of bronchopneumonia and (n=27, 15.4) with sepsis (online supplemental table). Of all 175 inpatient admissions (n=26, 15%) tested positive for COVID-19 on PCR. The IMR was 3/1000 live births. There were four deaths of which, (n=3, 75%) in ≤1 month (two attributed to sepsis and one bronchopneumonia) and (n=1,25%) in 1.1–3 months age group, secondary to meningoencephalitis (table 2).

Table 1 Baseline characteristics of febrile infants, ED, IHHN (n=2311)

Variables		n (%)
Gender	Male	1364 (59)
	Female	947(41)
Age group	<1 month	314 (13.6)
	1–3 months	507 (21.9)
	3.1–6 months	735 (31.8)
	6.1–12 months	755 (32.7)
Triage acuity*	P1	209 (9)
	P2	1659 (71.8)
	P3	354 (15.3)
	P4	84 (3.6)
	P5	5 (0.20)
Signs and symptoms	Cough	1002 (43.4)
	Diarrhoea	553 (23.9)
	Vomiting	416 (18)
	Respiratory distress	246 (10.6)
	Irritability	237 (10.3)
	Feeding inability	162 (7)
	Seizures	119 (5.1)
	Skin infection	57 (2.5)
	Abdominal pain	32 (1.4)
	Constipation	16 (0.7)
	Ear discharge	15 (0.6)
	Painful urination	8 (0.3)

*Triage acuity 33, 34: Manchester triage system+Paediatric Early Warning Score.
EDs, emergency departments; IHHN, Indus Hospital and Health Network; P1, immediate; P2, very urgent; P3, urgent; P4, standard; P5, non-urgent.

DISCUSSION

This study is the first in-depth analysis of the epidemiology of febrile infants in Pakistan. In this study, there

Table 2 Association between ages of children with provisional ED diagnosis and ED outcomes at ED, IHHN (n=2311)

	Ages of the children					
Provisional ED diagnosis	≤1 month n (%) 314 (13.6)	1.1–3 months n (%) 507 (21.9)	3.1–6 months n (%) 735 (31.8)	6.1–12 months n (%) 755 (32.7)	Total n (%)	
Abscess	2 (11.1)	7 (38.9)	5 (27.8)	4 (22.2)	18 (0.8)	P<0.001*
AGE	25 (7.9)	55 (17.3)	114 (35.8)	124(39)	318 (13.8)	
Bronchiolitis	18 (14.8)	46 (37.7)	40 (32.8)	18 (14.8)	122 (5.3)	
Bronchopneumonia	36 (7.5)	138 (28.6)	176 (36.4)	133 (27.5)	483 (20.9)	
Dengue fever/malaria	1 (5.9)	4 (23.5)	6 (35.3)	6 (35.3)	17 (0.7)	
Enteric fever	1 (2.8)	2 (5.6)	14 (38.9)	19 (52.8)	36 (1.6)	
Oncological disease	0 (0)	2 (22.2)	5 (55.6)	2 (22.2)	9 (0.4)	
Meningitis/encephalitis	5 (7)	22(31)	19 (26.8)	25 (35.2)	71 (3.1)	
Otitis media	0 (0)	0	2 (28.6)	5 (71.4)	7 (0.3)	
Sepsis	98(51)	47 (24.5)	32 (16.7)	15 (7.8)	192 (8.3)	
URTI	19 (4.4)	64 (14.7)	146 (33.6)	206 (47.4)	435 (18.8)	
UTI	0	4 (36.4)	2 (18.2)	5 (45.5)	11 (0.5)	
CVD	0 (0)	7 (6.8)	51 (49.5)	45 (53.7)	103 (4.5)	
Haematological disease	21 (34.4)	24 (39.3)	11(18)	5 (8.2)	61 (2.6)	
MSK disease	1 (2.6)	9 (23.1)	8 (20.5)	21 (53.8)	39 (1.7)	
Renal disease	18 (22.8)	13 (16.5)	35 (44.3)	13 (16.5%)	79 (3.4)	
Metabolic disease	3 (10.7)	0 (0)	1 (3.6)	24 (85.7)	28 (1.2)	
GI disease	19 (52.8)	1 (2.8)	4 (11.1)	12 (33.3)	36 (1.6)	
Oncological disease	0 (0)	2 (22.2)	5 (55.6)	2 (22.2)	9 (0.4)	
Dengue/malaria	1 (5.9)	4 (23.5)	6 (35.3)	6 (35.3)	17 (0.7)	
Neurological disease	17(50)	7 (20.6)	1 (2.9)	9 (26.5)	34 (1.5)	
Others	30 (14.2)	55 (25.9)	63 (29.7)	64 (30.2)	212 (9.2)	
Total	314 (13.6)	507 (21.9)	735 (31.8)	755 (32.7)	2311(100)	
ED outcomes						
Discharged	151 (12.7)	226 (19.1)	366 (30.9)	443 (37.4)	1186 (51.3)	P<0.001*
Admitted	26 (14.9)	39 (22.3)	59 (33.7)	51 (29.1)	175 (7.6)	
Left against medical advice	18 (15.4)	34 (29.1)	25 (21.4)	40 (34.2)	117 (5.1)	
Discharged on request	0	3 (30)	5 (50)	2 (20)	10 (0.4)	
Referred out	116 (14.2)	204 (24.9)	280 (34.2)	219 (26.7)	819 (35.4)	
Expired	3 (75)	1 (25)	0	0	4 (0.2)	

*χ^2.
AGE, acute gastroenteritis; CVD, cardiovascular disease; ED, emergency departments; GI, gastrointestinal ; IHHN, Indus Hospital and Health Network; MSK, musculoskeletal disease; URTI, upper respiratory tract infection; UTI, urinary tract infection.

was a preponderance of male patients in conformity with Pakistani literature.[34] Most infants presented in the age group of 6.1–12 months and, cough (43.4%) was the most frequent symptom, followed by diarrhoea (23.9%), as also affirmed by local[31 34] and international literature.[32 35] We reported 71.8% triages in P2 acuity, and 0.2% in P5 acuity, similar to local literature.[36] The considerable number of P2 acuity may be attributed to the overtriage tendency of our triage system. MTS has moderate specificity and sensitivity in paediatrics, leading to overtriage while maintaining sensitivity in high-urgency cases.[37 38] It requires febrile patients to be seen within 10 min, which sometimes may not be necessary in the clinical situation.[38] The addition of PEWS to MTS is known to improve triage, except in patients with high urgency.[39] We identify this limitation of our study, which requires further investigation since the utilisation of resources is mandatory in low-resource, high-volume EDs of LMICs.[40]

Among those ≤1 month of age, sepsis (51%) followed by bronchopneumonia (7.5%) was the most frequent provisional ED diagnosis. Among Pakistani literature, Gowa *et al*[21] reported the highest frequency of sepsis (23.8%)

Table 3 Association of provisional ED diagnosis with ED outcomes at ED, IHHN (n=2311)

Provisional ED diagnosis	ED outcomes					
	Discharged n (%)	Admitted n (%)	LAMA n (%)	DOR n (%)	Refer out n (%)	Expired n (%)
Abscess	6 (0.5)	4 (2.3)	1 (0.9)	0 (0)	7 (0.9)	0
AGE	192 (16.2)	20 (11.4)	14(12)	1 (10)	91 (11.1)	0
Bronchiolitis	48(4)	20 (11.4)	5 (4.3)	0	49 (6)	0
Bronchopneumonia	173 (14.6)	47 (26.9)	30 (25.6)	1 (10)	231 (28.2)	1 (25)
Enteric fever	20 (1.7)	5 (2.9)	1 (0.9)	1 (10)	9 (1.1)	0
Otitis media	3 (0.3)	0	0	0	4 (0.5)	0
Sepsis	16 (1.3)	40 (22.9)	11 (9.4)	0	123 (15)	2 (50)
URTI	358 (30.2)	12 (6.9)	10 (8.5)	2 (20)	53 (6.5)	0
UTI	6 (0.5)	1 (0.6)	2 (1.7)	0 (0)	61 (7.4)	0
Dengue fever/malaria	3 (0.3)	3 (1.7)	0	0	11 (1.3)	0
Oncological disease	0	8 (4.6)	1 (0.9)	0	0	0
CVD	22 (1.9)	1 (0.6)	4 (3.4)	0 (0)	76 (9.3)	0
Haematological disease	44 (3.7)	2 (1.1)	3 (2.6)	0	12 (1.5)	0
MSK disease	33 (2.8)	0	1 (0.9)	1 (10)	4 (0.5)	0
Renal disease	61 (5.1)	1 (0.6)	2 (1.7)	0	15 (1.8)	0
Metabolic disease	21 (1.8)	0	0	0	7 (0.9)	0
GI disease	28 (2.4)	3 (1.7)	4 (3.4)	1 (10)	0	0
Meningitis/encephalitis	2 (0.2)	7 (4)	10 (8.5)	0	51 (6.2)	1 (25)
Neurological disease	18 (1.5)	1 (0.6)	2 (1.7)	0	13 (1.6)	0
Others	132 (11.1)	0 (0)	16 (13.7)	3 (30)	61 (7.4)	0
Total	1186 (100)	175 (100)	117 (100)	10 (100)	819 (100)	4 (100)
P<0.001*						

*χ^2.
AGE, acute gastroenteritis; CVD, cardiovascular disease; DOR, discharge on request; ED, emergency department; GI, gastrointestinal ; IHHN, Indus Hospital and Health Network; LAMA, leave against medical advice; MSK, musculoskeletal; URTI, upper respiratory tract infection; UTI, urinary tract infection.

followed by bronchopneumonia. Habib and Khan[41] also reported respiratory illnesses, in affirmation of our findings. In our study, sepsis is attributed to 50% of deaths in ≤1 month of age. Similarly, Oza *et al*[42] reported sepsis (37.2%) as being the most common cause of death in the late neonatal period. According to the epidemiological data presented by Lawn *et al*,[43] 99% of newborn expiries occur in LMICs; with only 1% in high-income countries. The deaths occurring in this vulnerable age group are mostly due to the community spread of preventable diseases, inadequate nutrition, unhygienic environment, lack of education and poor socioeconomic status.[9] In Pakistan, maternal risk factors, premature birth and low birth weight[44] have been associated with increased risk of neonatal deaths. This is an area to contemplate; to improve patient outcomes. In comparison to international literature, we reported no case of UTI in this age group.[8] This may be due to inadequate urine sample collection in our patient population, a known cause for a challenging diagnosis.[45] In Pakistan, studies document a higher number of cases of UTI in children >1 year of age.[46]

In infants >1.1 to 6 months of age, bronchopneumonia, URTI and sepsis accounted for the most common provisional ED diagnoses. Similarly, Haji *et al*[8] reported pneumonia (11.6%) and UTI (6.2%) in ≤3 months of age. Shahid *et al*[47] reported sepsis to be the most common in the same. Among, 6.1–12 months of age, the most common provisional ED diagnosis was URTI, followed by bronchopneumonia. We observed a high trend of AGE, enteric fever and UTI in this age group, consistent with findings in Pakistani literature.[46 48] This may be due to poor hygiene, inadequate sanitary conditions and toilet training practices, and inept immunisation. Additionally, only 40% of Pakistani mothers exclusively breastfeed up to 6 months of age.[49]

Most of the infants were admitted to paediatric HDU with bronchopneumonia (29.6%) and sepsis (13%). Most admissions in PICU were for infants with bronchopneumonia (31.7 %) and sepsis (24.4 %); and in NICU, with sepsis (71.4%).

Table 4 Association of provisional ED diagnosis with Inpatient admission at ED, IHHN (n=2311)

Provisional ED diagnosis	Inpatient admission		
	Paediatric HDU n (%)	PICU n (%)	NICU n (%)
Abscess	4 (3.7)	0	0
AGE	17 (15.7)	2 (4.9)	1 (4.5)
Bronchiolitis	11 (10.1)	7 (17.1)	2 (9.1)
Bronchopneumonia	32 (29.6)	14 (31.7)	1 (4.5)
Enteric fever	5 (4.6)	0	0
Otitis media	0	0	0
Sepsis	14(13)	11 (24.4)	15 (71.4)
URTI	10 (9.3)	1 (2.4)	1 (4.5)
UTI	1 (0.9)	0	0
Dengue fever/malaria	3 (2.8)	0	0
Oncological disease	8 (7.4)	0	0
CVD	0	1 (2.2)	0
Haematological disease	1 (0.9)	1 (2.2)	0
MSK disease	0	0	0
Renal disease	1 (0.9)	0	0
Metabolic disease	0	0	0
GI disease	0	2 (4.9)	1 (4.8)
Meningitis/encephalitis	2 (1.8)	5 (11.1)	0
Neurological disease	0	1 (2.2)	0
Other	0	0	0
Total	109 (100)	45 (100)	22 (100)
P<0.001*			

*χ^2.
AGE, acute gastroenteritis; CVD, cardiovascular disease; ED, emergency department; GI, gastrointestinal disorder; HDU, high-dependency unit; IHHN, Indus Hospital and Health Network; MSK, musculoskeletal disease; NICU, neonatal intensive care unit; PICU, paediatric intensive care unit; URTI, upper respiratory tract infection; UTI, urinary tract infection.

The findings of our study indicate respiratory illnesses, followed by sepsis,[41] remain a major disease burden, conforming to national and international literature.[21 34 35 40 41 50 51] The ED and IHHN discharged 51.3% and admitted only 7.6% of infants. Unfortunately, due to the limited admission capacity of IHHN, 35.4% of patients were referred out after initial stabilisation. The outcomes of these patients remain unknown and are a limitation of our study. Moreover, this is indicative of the substantial disease burden, insufficient resources and lack of a national registry in Pakistan. This important finding highlights the need to expand IHHN services to accommodate a larger underserved population.

We reported an IMR of 3/1000. The low IMR reported in this study is not generalisable, as the denominator is diluted by missing data of LAMA, DOR and referred out critically ill infants. A study conducted in Karachi reported an ED mortality of 4.3%[35] and another study among children ≤16 years of age reported a mortality of 1.3%.[34] Similarly, a study in the Ethiopian population documented an ED mortality of 4%.[36] It is imperative to note that these studies included paediatric patients of all age groups, whereas our study focused on infants only.

The retrospective, single-centre nature of the study, limits its generalisability to a larger population. We relied on retrospective data from HMIS, which introduces the potential for information bias and restricts the control over the quality of data. Chart abstraction, a limitation of retrospective studies, was mitigated by having two independent investigators review the charts, with any conflict resolved by a third investigator. Despite, the substantial sample size, which has the potential for a comprehensive assessment of the epidemiology of febrile infants, we lack outcomes of patients who were referred out, LAMA and DOR, due to the absence of a national registry system. This has constrained the depth of our analysis. Additionally, we recognise that the use of MTS and PEWS in the ED, at IHHN, may have overtriaged the patients; thus, burdening the ED process flow. To the authors' best knowledge, literature delineating infant morbidity is limited.[36 52–54] This study is the first of its kind and heralds a significant step in understanding the epidemiology of febrile infants in Pakistan.

Table 5 Association between triage acuity and provisional ED diagnosis, ED, IHHN (n=2311)

Provisional ED diagnosis	Triage acuity* P1 n (%)	P2 n (%)	P3 n (%)	P4 n (%)	P5 n (%)	
Abscess	0	9 (0.5)	8 (2.3)	1 (1.2)	0	P<0.001*
AGE	6 (2.9)	190 (11.5)	113 (31.9)	9 (10.7)	0	
Bronchiolitis	8 (3.8)	109 (6.6)	3 (0.8)	2 (2.4)	0	
Bronchopneumonia	75 (35.9)	371 (22.4)	25 (7.1)	12 (14.3)	0	
Dengue fever/malaria	2 (1)	14 (0.8)	1 (0.3)	0	0	
Enteric fever	1 (0.5)	25 (1.5)	8 (2.3)	2 (2.4)	0	
Oncological disease	0	8 (0.5)	0	1 (1.2)	0	
Meningitis/encephalitis	16 (7.7)	49(3)	5 (1.4)	1 (1.2)	0	
Otitis media	0	1 (0.1)	6 (1.7)	0	0	
Sepsis	29 (13.9)	140 (8.4)	23 (6.5)	0	0	
URTI	17 (8.1)	331(20)	60 (16.9)	27 (32.1)	0	
UTI	1 (0.5)	6 (0.4)	3 (0.8)	1 (1.2)	0	
CVD	13 (6.2)	81 (4.9)	9 (2.5)	0	0	
Haematological disease	3 (1.4)	36 (2.2)	18 (5.1)	3 (3.6)	1 (20)	
MSK disease	0	18 (1.1)	11 (3.1)	7 (8.3)	3 (60)	
Renal disease	6 (2.9)	50 (3)	16 (4.5)	7 (8.3)	0	
Metabolic disease	2 (1)	13 (0.8)	11 (3.1)	2 (2.4)	0	
GI disease	5 (2.4)	23 (1.4)	7 (2)	1 (1.2)	0	
Neuro	2 (1)	15 (0.9)	15 (4.2)	2 (2.4)	0	
Others	23 (11)	170 (10.2)	12 (3.4)	6 (7.1)	1 (20)	
Total	209 (100)	1659 (100)	354 (100)	84 (100)	5	n=2311

*χ^2 test.
AGE, acute gastroenteritis; CVD, cardiovascular disease; ED, emergency department; GI, gastrointestinal disorder; IHHN, Indus Hospital and Health Network; MSK, musculoskeletal disease; P1, immediate; P2, very urgent; P3, urgent; P4, standard; P5, non-urgent; URTI, upper respiratory tract infection; UTI, urinary tract infection.

CONCLUSION

Despite the limitations, this study fills the gap in the literature by providing valuable insights into the morbidity patterns of febrile infants in Pakistan; marking respiratory illnesses and sepsis as the major contributors. The limited admission capacity at IHHN resulting in increased referrals and LAMA highlights the resource limitations in Pakistan. Thus, emphasising the pressing need to broaden our healthcare services, cater to the underprivileged population and improve patient outcomes.

RECOMMENDATION

The paediatric ED receives >300 to 350 patients/day while the admission capacity is much less. This leads to increased referrals after initial stabilisation and LAMA secondary to patient dissatisfaction. This underscores the importance of expanding our admission capacity to meet the demands of increased patient influx. Moreover, the healthcare system in Pakistan is rudimentary, and hospitals operate independently. To ensure adequate follow-up of referred-out patients, an effective communication network and a national registry system needs to be established. The authors hope this study will foster, future research aimed at optimising triage systems, delineating the frequency of sepsis in ≤1 month of age, improved national health systems and patient outcomes in high-volume, low-resource EDs.

Contributors and Guarantorship statement All the authors meet ICMJE criteria of authorship by meeting following points: (1) Substantial contributions to the conception or design of the work; or the acquisition, analysis or interpretation of data for the work; (2) Drafting the work or reviewing it critically for important intellectual content; (3) Final approval of the version to be published and (4) Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Bushra Q, serves as the guarantor for this article and accepts full responsibility for the integrity of the work as a whole. She was involved in the conception and design of the study, data collection, analysis, and interpretation, as well as the drafting and revision of the manuscript. Dr. Quratulain Bushra Noor Khuhro affirms that all data are accurate and that all aspects of the manuscript have been thoroughly reviewed and approved by the contributing authors.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

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

Patient consent for publication Not applicable.

Ethics approval Approval was obtained from the Institutional Review Board (IRB), under reference IRD_IRB_2021_01_020 on 21 February 2021.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement All data relevant to the study are included in the article or uploaded as online supplemental information.

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