

Understanding presentations of children with fever to a Sydney emergency department

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ABSTRACT

Background: Fever is a common childhood illness resulting in a potentially high number of presentations to local Emergency Departments (ED). This paper describes the characteristics of these presentations of children, including initial and subsequent diagnosis, disposition from ED and seasonal variations, to inform nursing and other health professionals working within these departments.

Methods: The study was conducted at a metropolitan hospital in Sydney, using existing data collected by emergency staff. Data for a 12-month period

were extracted from the existing database of all ED presentations.

Results: This study demonstrated that the age of the majority of febrile child presentations varied between 13 months and 24 months (53%), and the number of ED visits doubled during the winter months (33%). Most of the child presentations to ED in this study were not urgent (68%). Viral illness, upper respiratory tract infections, and urinary tract infections accounted for 14.9% of all the ED presentations, with most being discharged to home.

Conclusion: This study confirms the continuing pattern of inappropriate presentations to EDs of children with fever. Public education campaigns are needed to reduce these presentations.

Key Words: Australia; Children; Diagnosis; Emergency; Fever; Separations

INTRODUCTION

Fever in children is a very common sign and symptom and often leads to a significant number of children presenting to the ED and other healthcare facilities. Approximately 20% of pediatric attendances to ED are related to fever [1,2]. In the United States, there are approximately 5.4 million visits by children to EDs per year that are attributable to fever [3]. Similar patterns have been reported in Australian EDs [4].

Despite the high prevalence of presentations of febrile children to EDs, most of these cases are reported as being non-urgent and can be managed at home or by seeking care in a primary healthcare centre [1,2,5]. The reasons behind parents' choice to access the ED to manage fever are related to misconceptions and concerns about the severe complications of fever such as seizures, brain damage or death [1,2,5]. We sought to examine these presentations by children within an Australian ED.

Fever is an increase in body temperature to a level that is considered to be above normal. Normal body temperature is 37°C and one or more degree above this level is considered as a fever. However, body temperature varies between people and throughout the day. Circadian cycles influence the body temperature where it is lowest in the morning and rises to a maximum in the evening [6,7]. This change of temperature is linked with the sleep-wake cycle of an individual, and the range over which it fluctuates normally 1.3°C in adults [7]. Differences in body temperature occur according to age groups. There is a temperature variation between an infant, adult and older adult. The different factors that influence this variation in body temperature include: the size of body, fat accumulation, the rate of metabolism, body surface area, body weight, and the immune system [8,9]. Certain other factors that influence the body temperature include meal time, environmental conditions, physical activity, water, weather, and air quality [6].

Fever does not constitute a serious sign or symptom unless it rises to a significant level and remains persistently high. If a rectal measurement determines a temperature of 41.6°C or 107°F, then it is important to seek treatment and care [5]. A temperature above 41.6°C may cause serious complications such as cardiac issues, dehydration, stroke, seizures, and sometimes death [1,2]. Fever may occur as a defensive response to pathogens. These pathogens may not survive at a higher temperature and therefore they are killed or restricted from growth through an increase in body temperature

[8,10]. External pyrogens such as bacteria, viruses, fungal or parasitic infections are common causes of fever in children [3].

Common conditions caused by bacterial infections that result in a fever are meningitis, occult bacteraemia, urinary tract infections (UTI), acute otitis media, pneumonia, gastroenteritis, and upper and lower respiratory tract infections [7,11]. In addition, some non-infectious diseases such as rheumatic diseases, solid tumors, hematological diseases, and hematological diseases can also result in fever [12]. Most research on fever and its management has focused on children aged five years or younger due to the high prevalence of fever in this population [2,13]. Children younger than three months represent a group of infants who may require urgent thorough investigation if presenting with fever (NSW Department of Health, 2010). Accordingly, children younger than three months will be excluded from this study as complex diagnoses may be related to this group [14].

Other studies have been conducted worldwide on ED presentations of children [5,15], however there was no contemporary review of these presentations within Australia. This paper aims to determine the nature of ED presentations for children with fever. The study will consider the frequency of presentations, causation, and examine the seasonal variations within the Southern Hemisphere. This study provided key data for the conduct of a clinical trial within the same setting to investigate health literacy modified fever education program for parents with children presenting with fever.

METHOD

This study used secondary data analysis of existing clinical data for children aged between three months and five years who presented to the ED with fever as a main or associated complaint. The study data were extracted from the paediatric ED census within the FirstNet database for the year 2011 (January to December inclusive). FirstNet is a computer software tool specifically designed for maintaining records of patients' visits to the ED. This software is implemented to monitor and share with the other ED departments in New South Wales (NSW) hospitals. This system has been implemented in over 180 hospitals in NSW [16]. A major metropolitan ED with a co-located paediatric ED, in Sydney Australia, was the study site.

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Data preparation

The study's Ethical approval was sought from the state and area health service as well as the University (Health number HREC/11/LPOOL/265 and University number H9532). Access to records stored in the FirstNet database was granted after approval of the Data and Quality Manager of the study site. Access to these data was permitted for this study and the planned trial that followed.

The study excludes children below three months and older than five years from the scope of the study. Data were classified into two categories according to the age of the child: between 3 to 24 months; and 25 months to 5 years. Data related to the mode of separation (referred to as disposition) of the patient from the ED were coded as follows: 1- treatment is given as part of the follow-up appointment; 2- admissions made to the critical care ward; 3- admissions made to the non-critical care ward; 4- triage not seen by doctors; 5- doctor examined, but patient did not wait for the treatment.

Data analysis

Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 18 [17] (SPSS, 2011). Descriptive analysis included frequencies and percentages for the characteristics of child fever presentations. All the categorical variables were compared using the Chi-squared test, such as the mode of arrival, disposition, and discharge and diagnosis. Data have been presented graphically for seasonal variations of the ED presentations.

RESULTS

Sociodemographic characteristics of children

The results showed that the number of female children was higher than male children (55.3% girls, 44.7% boys). The most consistent age group that visited the EDs with fever as a chief complaint was children aged between 13-14 months (53%), followed by children aged 12 months (23.2%). There was a gradual decrease in fever presentations with older children; children aged between 37 months and 48 months (7.3%), and then children aged between 49 months and 60 months (5.6%).

Mode of arrival to ED

The private vehicle remained the most common mode of commuting to the hospital for febrile cases (90%), with only 8.7% arrived in an ambulance. Only a small number of cases (0.7%) were referred to regular checkup appointments after examination in the outpatient clinic. Few children (0.6%) arrived by walking to the ED.

Presenting problem and discharge diagnosis

A triage nurse was responsible for recording complaints from patients in the FirstNet system predominantly on two different occasions. First, presenting problem/chief complaint was recorded (what do parents/carers think or nurses observe) followed by the discharge/final diagnosis (after the ED medical officer had assessed the child). Some conditions were noticed at initial presentations. The highest was fever (29%) followed with fever and cough (11.6%), convulsion (5.4%), fever and vomiting (4.9%), fever and rash (3.8%), fever and shortness of breath (SOB) 2%, UTI combined with respiratory tract infections (1.1%), and viral illness (0.9%). The FirstNet codes did not specify other diagnoses, but the initial presentations were revised after assessments made by the medical officer (Table 1).

Frequency of child presentations based on presenting problem and discharge diagnosis (N=1581).

Child age and discharge diagnosis

Information regarding the child diagnosis on discharge has been presented in Table 2. The highest presentations were made in the group aged between 3 to 24 months (76.2%, n=1205). However, the total representations for children aged 25 months to 5 years accounted for 23.8% (376).

Frequency of child presentations based on diagnosis on discharge (N=1581).

Month and season of presentation

Presentations for child fever were not similar for all the months in a year. Seasonal variation occurred. The highest number of presentations were made during August 2011 accounting for 11.5% of the total presentations. Presentations of fever also varied with seasons (June to August being winter in the Southern Hemisphere) where the greatest proportion was reported (520 visits; 33%). A comparatively lesser number of visits (25%) were made during the months September, October, and November (spring to

Table 1

Frequency of child presentations based on presenting problem and discharge diagnosis (N=1581)

Diagnosis	Initial Presentation		Discharge Diagnosis	
	N	%	N	%
Convulsion or query convulsion	86	5.4	81	5.1
Fever	933	59	234	14.8
Fever and cough	184	11.6	17	1.1
Fever and rash	61	3.8	8	0.5
Fever and SOB	32	2	4	0.2
Fever and vomiting	77	4.9	22	1.4
URTI and UTI	17	1.1	235	14.9
Viral illness	14	0.9	237	15
Others not specified	125	8	296	18.7
No diagnosis recorded	52	3.3	447	28.2
Total	1581	100	1581	99.9

Note: The total does not sum to 100% due to rounding to one decimal point.

Table 2

Frequency of child presentations based on diagnosis on discharge (N=1581)

Discharge Diagnosis	Age in Months (M)				Total	
	3-24 (M)		25-60 (M)		N	%
	N	(%)	N	(%)		
Convulsion or query convulsion	63	(4)	18	(1.1)	81	(5.1)
Fever	185	(11.7)	49	(3.1)	234	(14.8)
Fever and cough	15	(0.9)	2	(0.1)	17	(1.1)
Fever and rash	4	(0.25)	4	(0.25)	8	(0.5)
Fever and SOB	4	(0.25)	0	(0)	4	(0.25)
Fever and vomiting	16	(1)	6	(0.4)	22	(1.4)
URTI and UTI	178	(11.3)	57	(3.6)	235	(14.9)
Viral illness	185	(11.7)	52	(3.3)	237	(15)
Others not specified	216	(13.7)	80	(5)	296	(18.7)
No diagnosis recorded	339	(21.5)	108	(6.8)	447	(28.2)
Total	1205	(76.3)	376	(23.7)	1581	(99.95)

SOB = shortness of breath; Upper respiratory tract infections = URTI, and urinary tract infections = UTI

Note: The total sum is not 100% due to rounding.

Table 3

Frequency of child presentations based on disposition after treatment (N=1581)

Disposition (separation)	No.	(%)
Refused to wait, not seen	145	9.2
Registered with triage nurses, but did not complete the treatment	43	2.7
Discharge home with follow-up	894	56.5
Admitted but not to the critical ward	493	31.2
Admitted to the critical ward	2	0.1
Unknown	4	0.2
Total	1581	99.9

Note: The total does not sum to 100% due to rounding to one decimal point.

summer) followed with 349 visits (22%) made during the months March, April, and May (autumn). However, the lowest numbers of child fever cases were recorded in summer in the Southern Hemisphere during December, January, and February (315 visits; 20%).

Child disposition after treatment

The study also examined child disposition or how the children left ED after seeking assessment and treatment. The triage nurse registered 9.2% patients who failed to wait. Medical officers provided assessment for 2.72% patients, who did not complete the treatment i.e., did not wait for the medical reports/ assessments requested by the medical officer. The majority of children (56.5%) were discharged to home after completing their prescribed treatment with follow-up appointments scheduled for the general

practitioner. A small number of children presented in a critical condition (0.13%) and were admitted to the critical care ward. One-third of children (31.2%) were admitted in the non-critical care ward for treatment, and only 0.25% had no records (Table 3) [18].

Frequency of child presentations based on disposition after treatment (N=1581)

DISCUSSION

Fever in infants and children are a common concern for parents and one of the most common causes for ED visits and medical consultations. Although the introduction of vaccines has reduced the incidence of serious communicable infections, fever plays a major role in the request for laboratory investigations and hospital admissions [7]. We undertook this study in preparation for a subsequent trial of an educational program aimed to increase parents' awareness about fever management to reduce unnecessary ED presentations. The availability of data on ED presentations within the FirstNet database provided an opportunity to explore critical variables such as the distribution of ages of children presenting to ED with fever, the presenting problem and discharge diagnosis, and the mode of arrival and disposition. These variables were investigated in previous studies focusing on fever in children [13,19].

Child's gender and age

The number of female patients in this study was higher than expected, females (55.3%) vs. males (44.7%). This sample represents Australian children with a higher proportion of females and a lower proportion of males than is seen in the Australia population: 48.78% females and 51.22% males [20].

Children aged 3 months to 36 months formed the majority of child presentations for fever. However, children aged 24 months and below remained the most prevalent group to present with fever. These findings are consistent with previous research conducted [19,21]. The majority of previous research did not include infants younger than three months since the children presenting with fever during this age require urgent hospital admissions and assessment [11,22]. The incidence of fever among neonates has different implications as compared to the older children. This is mainly because of the differences in the body size, immune system, metabolic rates, and the ratio of body surface to the weight [11]. In the present study, children aged four and above demonstrated the lowest number of presentations than the other age groups. The fact that fever presentations are lower for this age group can be attributed to immunisations, decreased metabolic rates, increased activity, increased body size, stabilisation of the sleep-wake cycles [8,9].

Seasonal variation

Fever presentations revealed a variation by month and season. The highest frequency of child fever presentations was in the winter months of June, July and August (33%) within the Southern Hemisphere. These results are not surprising since viral illnesses typically increase dramatically in the winter months [12]. Most of the illnesses reported in this study were fever, fever and cough, fever and vomiting, fever and rash, fever and SOB, convulsions, Upper Respiratory Tract Infection (URTI) and UTI, and non-specific other viral illness. Accordingly, for any clinical trial aimed to explore childhood illness such as common cold or fever, it is recommended that the trial is conducted in winter months because this period presents the peak season for child presentations for fever. The summer months presented only 20% of the total fever presentations among children. This decline in a number of fever presentations during the summer period can be attributed to school holidays [23], with children being less exposed to school infections.

Presenting problem, discharge diagnosis, and child disposition

There was a slight mismatch between the evaluation of children's complaints at the time of presentation (what parents/carers think or nurses observe) compared to discharge diagnosis (after medical officers' evaluations). In 59% of cases, parents linked their child's complaint to fever while only 14.8% of these complaints and symptoms turned out to be only related to fever after medical officers' evaluations. Viral illnesses were thought to be causing fever in 0.9% of the total presentations initially and in 15% of the cases at discharge. The disparity between the parents/carers' initial evaluation and the discharge diagnosis underscores the fact that fever is not a disease within itself, but rather a sign and symptom of disease [15,24]. Misconceptions about the causes and possible side effects of fever explain the unnecessary visits to EDs by concerned parents/carers with a febrile child. These data suggest that information about the underlying cause of fever in children

could be useful to parents/carers. Other authors have noted that parents/carers have difficulties in assessing the child's illness and its severity leading to often unnecessary visits to the nearest healthcare facility [1,2].

The observation that 68.4% of the total number of children presenting to the ED with fever were discharged home or refused to wait indicates that fever may not have been urgent enough to warrant attention at the ED or could be managed at primary care centres. Most of the child presentations arrived at ED by a private vehicle (90.6%), with only 8.8% transported by ambulance. These data support the view that most child fever presentations to the ED are non-urgent. Urgent admission to the critical care ward was only needed for two children, i.e. 0.13%. In contrast to this, a larger number of children (31.2%) required admission to the general ward.

Findings made in previous studies conclude that the majority of children presenting to the ED are non-urgent and can easily be managed at home without visiting the primary care centers [14]. Indeed, the majority of presentations to the paediatric ED visits (82%) are non-urgent [14]. These findings have been reflected in a survey conducted among the Australian parents in 2005 where only a limited number of parents (19.5%) were able to identify fever, while 41.5% would of sought medical advice for slight changes in temperature [4].

Certain limitations and challenges have arisen during this study. First, the coding of some data items in the FirstNet database was ambiguous and unclear. There was an overlap found between the conditions chiefly reported for fever and respiratory issues. There was a lack of clarity about whether the respiratory problems were related to cold, cough, URTI or any other illness. Another issue was that the researcher faced regarding coding was the cases for initial diagnosis as these can be interpreted in more than one way based on the conditions reported by their parents, caregivers, or a triage nurse. One important specification that was found absent in the FirstNet was regarding the cases that were deemed urgent. The researcher was not able to verify that the presentations made were urgent and non-urgent cases. An additional data item that could be included in the ED FirstNet database is the level of urgency for patients attending ED. For future studies, the urgency of a child's condition can be determined retrospectively by investigating other variables, such as mode of arrival at ED (ambulance or car) and the need for admission to critical care ward [25].

CONCLUSION

Fever remains a common sign and symptom in young children (five years of age and younger). This Australian study used existing data to explore the characteristics of febrile children presenting to ED. Fever presentations by children and their parents/carers vary by month and season, with the winter months (July to August) being the most frequent, and summer months (December and January) being the least frequent. Additionally, results from this study confirm that the majority of children with fever presentations at ED are non-urgent, and could potentially be managed at home.

The findings thus far clearly illustrate that the most favourable time to investigate a large number of febrile children is during the winter months. Furthermore, it is evident that some illnesses can be associated with fever, such as skin rash, shortness of breath, and vomiting.

Findings from this study can be applied more broadly, for example, to educate triage nurses and other health professionals on issues related to children presenting with fever to the ED. Further research should focus on the implementation of strategies that improve a parent's understanding of fever as a symptom, and when it is necessary to seek health professional assistance, thus reducing subsequent unnecessary hospital visits.

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