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Evaluation of unplanned reattendances to the pediatric emergency department – a five-year study

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Abstract

Background Unplanned reattendances (UR) are an important quality indicator in the emergency department (ED). Understanding the risk factors associated with UR can aid clinicians in optimizing the allocation of time and resources, as well as targeted counselling for this specific group of patients. In this study, we aimed to compare patient characteristics between children who attended a pediatric emergency department (ED) with unplanned reattendances (UR) and those without UR. We also aimed to study the association between healthcare delivery factors such as timing of the attendance, patient load, changeover months for rotating junior doctors, presence of supervision, and rate of UR.

Study design We performed a retrospective, single-center cohort study of patients < 18 years old who visited the ED between January 2018 and March 2023. UR was defined as a revisit within 72 h of the index ED visit. We collected data on demographics, attendance data and clinical characteristics. Logistic regression was performed for factors independently associated with UR, after adjusting for age, patient acuity, timing of attendance, presence of senior doctor supervision, rotation months for junior doctors, and diagnostic category.

Results Out of the 544,699 eligible children, 24,733 (4.5%) reattended the ED within 72 h, of which 10,915 (44.1%) of them were hospitalized on their reattendance visit. The independent factors associated with UR were young age (age < 3 years old: aOR 1.585 95%CI 1.481–1.698, $p < 0.001$), high acuity P2+ (aOR 1.398 95%CI 1.354–1.444, $p < 0.001$), attendance in the evening (aOR 1.086 95%CI 1.055–1.117, $p < 0.001$) and night (aOR 1.365 95%CI 1.314–1.417, $p < 0.001$), gastrointestinal diagnosis (aOR 1.528, CI 1.469–1.588; $p < 0.001$) and respiratory diagnosis (aOR 1.155, CI 1.121–1.189, $p < 0.001$).

Conclusions We identified independent risk factors for UR that could guide resource allocation. Future studies should investigate if targeted interventions may reduce UR in these at-risk populations.

Keywords Children emergency, Emergency department, Risk factors, Reattendances, Return visits

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Introduction

Unplanned reattendance (UR) visits in Emergency Departments (EDs) range between 2.7% and 6.5% [1–7]. UR visits add to the high workload of ED physicians, increase waiting time and lead to patient dissatisfaction [8]. UR visits increase healthcare costs due to multiple hospital visits, a greater number of investigations ordered and a higher likelihood of being hospitalized even in the absence of increasing illness severity [1, 2]. High UR rates may indicate possible medical errors such as misdiagnosis and inappropriate management [9]. It is therefore a commonly used clinical quality indicator to assess care and communication delivered during the patient's visit [10–13].

Based on previous studies, reasons for UR can be broadly classified into the following categories: illness-related, doctor-related, patient-related and systems-related [14, 15]. In illness-related UR, the patient returns due to natural progression of the disease. In doctor-related UR, the patient returns due to misdiagnosis or poor communication at initial discharge. In patient-related UR, returns are primarily driven by patients or in the context of pediatric patients, by parents of patients. Patients may prefer to return to hospital-based care because of a one-stop center convenience including accessibility to specialists and further investigations [14, 16]. Systems-related UR happens when early subspecialty reviews are unavailable or when clinics are closed due to public holidays. Common illness- and patient-related risk factors for UR identified by previous studies in the pediatric population were young age, higher acuity at presentation, respiratory and gastrointestinal illnesses [3–5, 16]. Identifying high-risk factors associated with UR can aid clinicians in optimizing the allocation of time and resources, as well as targeted counselling for this specific group of patients.

A previous study from the same institution published in 2015 reported UR of 4.3%. However, that study was limited by small sample size as the study was carried out over a 1 year period [1]. Therefore, we aim to compare patient characteristics among children who attended a pediatric ED with UR to those without, in a large tertiary institution over a period of 5 years. The secondary aim is to study the association between disease categories, healthcare delivery factors such as timing of the attendance, patient load, changeover months for rotating junior doctors, presence of supervision, and rate of UR. We hypothesize that young age, high acuity at presentation, having gastrointestinal and respiratory diagnoses, absence of senior supervisorship, attendance during a busy shift such as evenings and high-volume days, as well as during junior doctor changeover months, are associated with increased risk of UR.

Methods

We performed a retrospective, single-center cohort study of patients who presented to KK Women's and Children's Hospital Emergency Department (KKH ED), between 1 January 2018 and 31 March 2023. KKH ED is the larger of 2 pediatric EDs in Singapore, with an annual attendance of about 170,000 patients. Our ED serves children <18 years old. In order to determine the population at risk of UR, we excluded patients who at the index visit were: hospitalized, discharged at own risk, absconded, left without being seen, referred to other hospitals/centers, or who were dead on arrival. Our ED does not have a system of planned reattendance visits. Patients who require review are given follow-up appointments at primary care or specialist outpatient clinics.

Study variables

We defined the index visit as the first visit during the study period. We defined a re-attendance (UR) as a return visit within 72 h of the index visit [1, 15]. We extracted the following data for all index visits from our electronic medical records system: patient demographics including age and sex, mode of arrival, time and date of arrival and disposition, triage category, discharge diagnosis and whether there was senior doctor supervisorship. An additional variable collected for the reattendance visit included change in triage category.

At the ED triage, trained nurses assess the patient's presenting complaint, clinical condition and vital signs and assign them to one of four triage categories according to the Singapore Pediatric Triage Scale [18], a four-level triage system:

- (a) Priority 1 (P1) refers to emergent cases that require immediate medical attention and are seen in the resuscitation room.
- (b) Priority 2 plus (P2+) refers to urgent cases that are at high risk of deterioration and are expected to be seen within 15 min from the time of arrival.
- (c) Priority 2 (P2) refers to less urgent cases that are expected to be seen within 45 min from time of arrival.
- (d) Priority 3 (P3) refers to non-urgent cases.

The selection of age groups was based on a prior pilot study [1]. Time of visit was defined as time of arrival at triage and was divided into three timings: (0001–0800 h, 0801–1600 h, 1601 h–0000 h). Days of the week were defined as high volume days (HVD) and low volume days (LVD). HVD included Sunday and Monday and LVD included Tuesday through to Saturday. Changeover months included January and July while the rest of the months were non-changeover months. During changeover months, KKH ED receives rotating new junior

doctors who comprise of pediatric residents, family medicine residents, emergency medicine residents, or non-differentiated medical officers. During the first month of rotation, junior doctors may receive supervision from a senior doctor for all their cases. Subsequently, this supervision may be limited to complex or urgent cases.

The diagnosis categories were classified based on the diagnostic codes (Systematized Nomenclature of Medicine Clinical Terms Codes, or SNOMED CT Codes) they received at the index visit. Diagnoses were grouped into respiratory-related infections, gastrointestinal tract-related infections, trauma and others. We specifically chose respiratory and gastrointestinal tract-related infections as we hypothesized that they were associated with higher rates of reattendances. Trauma was also chosen because this is an important category that constitutes a large proportion of ED visits [1, 4, 19].

To reduce the risk of bias, data extraction was done by an independent data extractor who was not aware of the study aim.

Ethics approval was obtained with waiver of consent from the Centralized Institutional Review Board (CIRB 2021/2122) in Singapore.

Statistical analysis

Statistical analysis was carried out using the software R version 4.0.5. We compared the group with reattendance to the group without reattendance. Categorical variables were presented using absolute numbers and percentages, while continuous variables were presented using mean (with standard deviation, or SD), or median (with interquartile range, or IQR), depending on normality. We analyzed measures of associations using the chi-square test for categorical variables, and the student t-test or Wilcoxon rank sum for continuous variables, depending on normality. We performed logistic regression to address confounders and to determine the adjusted odds ratio (aOR), with the corresponding 95% confidence interval (95% CI) for factors independently associated with reattendance. The variables were chosen either based on established risk factors from previous literature [3–5, 15, 17], univariate statistical significance, or by clinical rationale. For instance, busier shifts or staff changeover months, especially those lacking senior supervisorship, could be associated with increased odds of UR. Statistical significance was set at $p < 0.05$.

Results

Among 688,150 visits during the study period, 544,699 visits were eligible for this study (Fig. 1). There were 24,733 reattendances (4.5%) to the ED within 72 h. Among the reattendance visits, nearly half (10915/24733, 44.1%) resulted in hospitalization.

Children under 3 years old made up 41.8% ($n=227713/544699$) of total attendances at the index visit and were more likely to reattend compared to older children (5.8% for <3 years old, 4.2% for 3–6 year olds, 3.2% for 6–12 year olds, and 2.7% for >12 year olds, $p < 0.001$) (Table 1). While the overall racial distribution was similar to that of the general Singapore population [20], Chinese had a greater rate of reattendance compared to the Indians, Malays and those of other races (5.0% vs. 4.3%, 4.0%, 3.9%, $p < 0.001$). Males and females had a similar rate of reattendance (4.5% vs. 4.6%, $p = 0.211$).

While patients with a triage status of P3 comprised the largest group of overall attendances in the ED ($n=273615/544699$, 50.2%), P2+ patients had the highest rate of reattendance ($n=6414/99718$, 6.4%) among all triage categories (Table 1). Those who arrived via own or public transport comprised the largest proportion of overall attendances, and had a higher rate of attendance compared to those who arrived by private ambulance, public ambulance and other means (4.6% vs. 2.4% vs. 3.8% vs. 3.0%, $p < 0.001$).

Although respiratory complaints constituted the largest proportion of overall attendances ($n=175177/544699$, 32.2%), gastrointestinal complaints had a higher rate of reattendance compared to respiratory, trauma or other complaints (6.9% vs. 5.5% vs. 1.3% vs. 4.5%, $p < 0.001$). Although more patient visits occurred on LVD (Tuesdays to Saturdays) (68.4%) compared to HVD (Sundays and Mondays) (31.6%), there was a higher reattendance rate on HVD than LVD (4.6% vs. 4.5%, $p = 0.031$). Although most of the patients arrived between 0801 and 1600 and 1601–0000 h (45.8% and 43.0% respectively), those who attended between 0001 and 0800 h had a higher rate of reattendance compared to those who attended between 0801 and 1600 and 1601–0000 h (6.6% vs. 4.1% vs. 4.5%, $p < 0.001$). The rate of reattendance between those who attended at changeover months (compared to non-changeover months), and between cases who received supervision (compared to those who did not), were comparable (Table 1).

In the multivariable logistic regression (Table 2), young age (age < 3 years old: aOR 1.585 95% CI 1.481–1.698, $p < 0.001$), high acuity P2+ (aOR 1.398 95% CI 1.354–1.444, $p < 0.001$), gastrointestinal diagnosis (aOR 1.528, CI 1.469–1.588; $p < 0.001$) and respiratory diagnosis (aOR 1.155, CI 1.121–1.189, $p < 0.001$), attendance in the evening (aOR 1.086 95% CI 0.055–1.117, $p < 0.001$) and night (aOR 1.365 95% CI 1.314–1.417, $p < 0.001$) were independently associated with reattendance. Those who arrived by ambulance had lower odds of reattendance (aOR 0.898, CI 0.817–0.984, $p = 0.23$). The odds of reattendance were not significantly influenced by HVD (compared to LVD), changeover month (compared to non-changeover

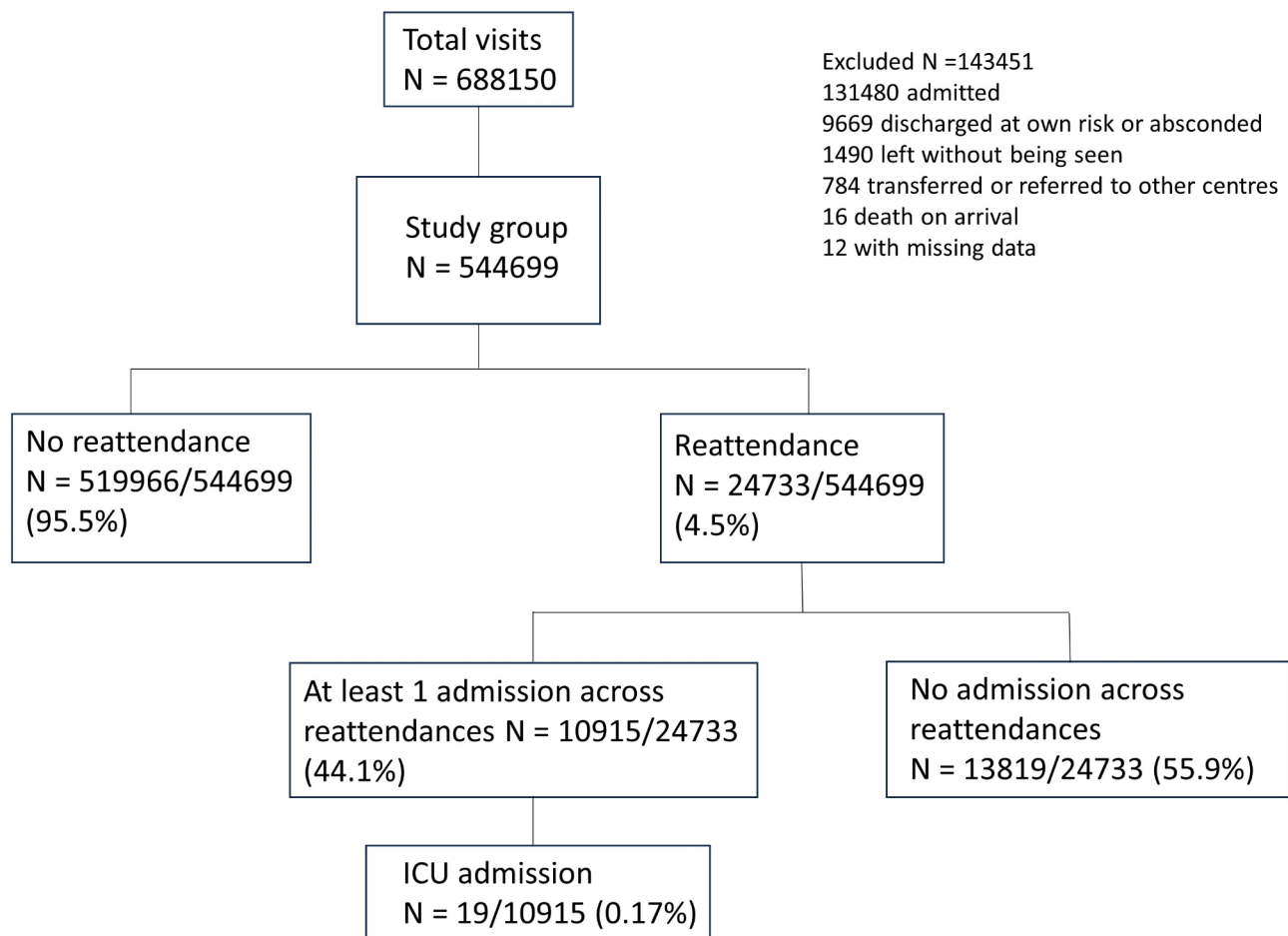


Fig. 1 Patient flow chart showing reattendance visits, exclusion criteria and admissions across reattendance visits from 1 January 2018 to 31 March 2023

month) and presence of senior doctor supervision (compared to no supervision).

At the reattendance visit, 49.1% ($n=12156$) of the patients remained in the same triage category, 29.4% ($n=7263$) saw an increase in triage category and 21.5% ($n=5315$) saw a decrease in triage category. In the reattendance group, 0.17% ($n=19$) patients were admitted to the intensive care unit as compared to 0.51% ($n=677$) across all visits.

Discussion

This is the first large scale study to assess the rate of UR and its risk factors in a Singapore pediatric ED setting. The rate of UR was 4.5% in our study, similar to other pediatric studies that reported UR rates between 2.7% and 6.5% [1–7]. We identified several independent risk factors for UR, such as young age (<3 years old), high acuity, attendances in the evening and night, as well as having diagnoses involving the respiratory or gastrointestinal systems.

Most studies found that young age is a significant risk factor for UR [1, 5, 16, 19, 20]. Infants and young children

with immature immune systems are known to be more vulnerable [21], therefore physicians may be more cautious in advising parents to return in the event of persistence of symptoms. Because young children (<3 years old) do not express their symptoms well, parents themselves may have a lower threshold to revisit the ED. We did not find that adolescents were at increased risk of UR, unlike another study that found increased UR rates among adolescents, and attributed this to decreased adherence to treatment, as well as patient reservations about going to their primary physicians [2]. Similar to other studies, we found that sex was not associated with an increased odd of UR [3, 10, 19, 20].

We found that gastrointestinal and respiratory diagnoses have increased odds of UR, which is consistent with previous literature [1, 3–717]. Interestingly, our study revealed that children with gastrointestinal diagnoses exhibited higher odds of UR compared to those with respiratory diagnoses, contrary to other studies where respiratory diagnoses were identified as a stronger risk factor [1, 517]. In our hospital, children presenting with vomiting are given anti-emetics in the hospital, and

Table 1 Patient demographic and clinical characteristics stratified by presence of reattendance

Characteristics	Overall, N=544,699 (%)	No Reattendance N=519,966(%)	Reattendance N=24,733 (%)	P value
Age group (years)				
< 3	227,713 (41.8)	214,554 (94.2)	13,159 (5.8)	< 0.001
3 to 6	168,380 (30.9)	161,311 (95.8)	7069 (4.2)	
6 to 12	112,837 (20.7)	109,281 (96.8)	3556 (3.2)	
> 12	35,769 (6.6)	34,820 (97.3)	949 (2.7)	
Gender				
Female	241,464 (44.3)	230,404 (95.4)	11,060 (4.6)	0.211
Male	303,235 (55.7)	289,562 (95.5)	13,673 (4.5)	
Race				
Chinese	286,610 (52.6)	272,270 (95.0)	14,340 (5.0)	< 0.001
Indian	77,533 (14.2)	74,224 (95.7)	3309 (4.3)	
Malay	115,447 (21.2)	110,876 (96.0)	4571 (4.0)	
Others	65,109 (12.0)	62,596 (96.1)	2513 (3.9)	
Mode of Arrival				
Own / Public Transport	530,084 (97.3)	505,844 (95.4)	24,240 (4.6)	< 0.001
Private Ambulance	4205 (0.8)	4103 (97.6)	102 (2.4)	
SCDF Ambulance	10,005 (1.8)	9626 (96.2)	379 (3.8)	
Others	405 (0.1)	393 (97.0)	12 (3.0)	
Triage category				
P1	2348 (0.4)	2251 (95.9)	97 (4.1)	< 0.001
P2	169,018 (31.0)	163,313 (96.6)	5705 (3.4)	
P2 +	99,718 (18.3)	93,304 (93.6)	6414 (6.4)	
P3	273,615 (50.2)	261,098 (95.4)	12,517 (4.6)	
Diagnosis category				
Gastrointestinal	55,679 (10.2)	51,813 (93.1)	3866 (6.9)	< 0.001
Respiratory	175,177 (32.2)	165,458 (94.5)	9719 (5.5)	
Trauma	95,143 (17.5)	93,882 (98.7)	1261 (1.3)	
Others	218,700 (57.6)	208,813 (95.5)	9887 (4.5)	
Time of visit				
0001–0800 h	61,255 (11.2)	57,182 (93.4)	4073 (6.6)	< 0.001
0801–1600 h	249,453 (45.8)	239,266 (95.9)	10,187 (4.1)	
1601 h–0000 h	233,991 (43.0)	223,518 (95.5)	10,473 (4.5)	
Days of the week				
High volume days	171,995 (31.6)	164,031 (95.4)	7964 (4.6)	0.031
Low volume days	372,704 (68.4)	355,935 (95.5)	16,769 (4.5)	
Month				
Changeover month	106,396 (19.5)	101,660 (95.5)	4736 (4.5)	0.12
Non-changeover month	438,303 (80.5)	418,306 (95.4)	19,997 (4.6)	
Supervisorship				
Not supervised	469,962 (86.3)	448,639 (95.5)	21,323 (4.5)	0.763
Supervised	74,737 (13.7)	71,327 (95.4)	3410 (4.6)	

* Percentages in the first column are taken based on the overall number 544699. Percentages in the columns 'No Reattendance' and 'Reattendance' are taken by row and each row adds to 100%. SCDF=Singapore Civil Defence Force. P1=priority 1, P2+=priority 2 plus, P2=priority 2 and P3=priority 3

upon discharge are advised to return if they have persistent vomiting or signs of dehydration. We recognize that some of these URs may have occurred due to natural progression of disease. Future research should stratify reattendances into those that are due to natural progression (therefore “unpreventable”) compared to those that involve missed diagnoses, inadequate communication, and other factors which can be modified by targeted interventions. On the other hand, we found that trauma

cases were less likely to reattend, likely because their clinical needs (including open wounds, contusions, fractures and dislocations) were met at the index visit.

After adjusting for other factors such as age, diagnosis and time of attendance in the multivariable analysis, a triage category of P2+ was still an independent risk factor for UR, consistent with past studies [119, 21]. This suggests that a significant number of patients with urgent conditions not related to respiratory or gastrointestinal

Table 2 Univariate and multivariable regression on factors associated with 72 h unplanned reattendance

Variable	Unadjusted Odds Ratio	p-value	Adjusted Odds Ratio	p-value
Age group (years)				
> 12	Ref		Ref	
< 3	2.25 (2.106–2.407)	< 0.001	1.585 (1.481–1.698)	< 0.001
3 to 6	1.608 (1.502–1.723)	< 0.001	1.266 (1.182–1.359)	< 0.001
6 to 12	1.194 (1.111–1.284)	< 0.001	1.077 (1.002–1.16)	0.046
Sex				
Female	Ref		Ref	
Male	0.984 (0.959–1.009)	0.209	1.01 (0.984–1.036)	0.468
Mode of arrival				
Non-ambulance	Ref		Ref	
Ambulance	0.731 (0.666–0.801)	< 0.001	0.898 (0.817–0.984)	0.023
Triage category				
P3	Ref		Ref	
P1	0.899 (0.728–1.096)	0.306	1.079 (0.872–1.318)	0.473
P2	0.729 (0.706–0.752)	< 0.001	1.086 (1.05–1.124)	< 0.001
P2+	1.434 (1.39–1.479)	< 0.001	1.398 (1.354–1.444)	< 0.001
Diagnosis category				
Others	Ref		Ref	
Gastrointestinal	1.576 (1.516–1.637)	< 0.001	1.528 (1.469–1.588)	< 0.001
Respiratory	1.241 (1.205–1.277)	< 0.001	1.155 (1.121–1.189)	< 0.001
Trauma	0.284 (0.267–0.301)	< 0.001	0.312 (0.293–0.332)	< 0.001
Time of visit				
0801–1600 h	Ref		Ref	
0001–0800 h	1.673 (1.611–1.737)	< 0.001	1.365 (1.314–1.417)	< 0.001
1601 h–0000 h	1.101 (1.07–1.132)	< 0.001	1.086 (1.055–1.117)	< 0.001
Days of the week				
Low volume days	Ref		Ref	
High volume days	1.031 (1.003–1.059)	0.031	1.007 (0.979–1.035)	0.634
Month				
Non-changeover month	Ref		Ref	
Changeover month	0.975 (0.943–1.007)	0.118	0.977 (0.946–1.009)	0.164
Supervisorship				
Not supervised	Ref		Ref	
Supervised	1.006 (0.969–1.044)	0.756	1.015 (0.977–1.055)	0.436

complaints are likely to reattend after the index visit. These P2+ patients deserve further investigation into causes of UR. We did not find a significant increased rate of UR in our P1 patients, likely because most of them would have been admitted at the index visit, due to severity of their illness. Another study reported that patients with Australasian Triage Scale (ATS) category 3 had higher rates of UR, likely because ATS 1 and 2 patients were more likely to be admitted at the index visit [7].

Our study reported the highest rates of UR when the index visit occurred in the night (0001 h to 0800 h), followed by evening (1601 h to 0000 h), compared to daytime (0801 h to 1600 h). While some studies similarly found a higher rate of UR after office hours [321], others reported a higher rate of UR in the mornings and early afternoons [2]. We postulate that these differences may be explained by different dynamics between patient volume and available staffing across different EDs at

different times of the day. In our ED, busy evening shifts may result in a backlog of waiting patients that are seen during the night shift, when manpower (for both doctors and nurses) is less compared to morning and evening shifts. This may result in time-pressured consults and decision-making, resulting in higher rates of UR. Our findings therefore inform decisions on manpower planning to meet clinical needs. While our study focused on the outcome of UR, other quality indicators including patient satisfaction would be necessary to understand if care delivery through the day and night are comparable.

We did not find an increase in UR rates during changeover months and absence of senior supervision, contrary to our hypothesis. This could be explained by intentional closer supervision by seniors during changeover months where most cases need to be vetted by senior doctors. During other months, senior doctors may generally focus

on the sicker children leaving junior doctors to care for patients with lower acuity.

Of note, the admission rate in the reattendance group more than doubled at 44.1% compared to an overall admission rate of 19.1%, a finding comparable to other studies [1, 2, 4, 5, 719, 23]. This increase in hospitalization was only partly accounted for by an increase in acuity. We found that 29.4% of URs had an increased triage acuity compared to the index visit, while 21.5% had a decrease in triage acuity. Therefore, we postulate that other factors such as a lower threshold for doctors to hospitalize reattendance cases and parental anxiety might prompt hospitalization. Future studies should investigate the reasons for admission at UR visits.

UR visits increase the workload for doctors, increase waiting times for patients and inflate overall healthcare costs. To minimize UR rates, interventions should be directed specifically at high-risk patient groups, including young children and those with gastrointestinal and respiratory-related diagnoses. These patients should be provided with adequate counselling on safe monitoring and given clear indications for return. These measures may be especially relevant during busy shifts such as evening and night shifts. Previous studies have established that caregiver confidence at managing ill children at home is key [24, 25]. This highlights the need for targeted caregiver training and education prior to discharge. Other ways to reduce unnecessary URs include the avenue for an early follow-up consult, either in-person or via telemedicine. Our hospital started an early follow-up telemedicine service, which has circumvented the problem of long waiting times to a clinic follow-up. For children who might benefit from a short stay, we have implemented a 24-hour early discharge unit in our ED that facilitates closer monitoring of respiratory and gastrointestinal illnesses, which were identified in our study as the most common diagnoses for URs.

We recognize the limitations in our study. Firstly, we performed a high-level ecological study and were unable to investigate individual factors such as details of discharge counselling, parental health literacy and socioeconomic status of the child/family. Secondly, we were unable to ascertain the reasons for UR without reviewing individual patient records. Future research should take into account the reasons for UR. Being a single center study, our findings need to be validated in a separate cohort before it can be considered generalizable. Because our ED uses a 72 h period as the definition for reattendance, we followed this definition for our study, rather than a 7-day period as reported elsewhere [1117].

In conclusion, we found that children with young age, those attending the ED in the evening or night, and those with high acuity gastrointestinal or respiratory illnesses had a higher risk of UR. Future research should

investigate if targeted counselling and interventions for at-risk groups reduce UR rates.

Abbreviations

UR	Unplanned reattendance
ED	Emergency department
KKH ED	KK Women's and Children's Hospital Emergency Department
P1	Priority 1
P2+	Priority 2 plus
P2	Priority 2
P3	Priority 3
HVD	High volume days
LVD	Low volume days
aOR	Adjusted odds ratio
CI	Confidence interval

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Author contributions

TL: Wrote the main manuscript text, contributed to the conceptualization, methodology and data analysis. LJW and JDN: Did the validation of data and data analysis. ASH and SG: Contributed substantially to the study design, as well as review and editing of manuscript. CSL: Overall supervision of the study design and data analysis, review and editing of the manuscript. All authors reviewed the manuscript.

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Data availability

The datasets generated during and/or analyzed during the current study are not publicly available but are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

Ethics approval was obtained with waiver of consent from the Centralized Institutional Review Board (CIRB 2021/2122) in Singapore.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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