

Asthma in emergency departments: Combined adult and paediatric versus paediatric only centres

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Objective: To compare the management of paediatric patients with mild or moderate asthma in paediatric-only emergency departments (POEDs) to treatment in a mixed adult-child emergency departments (mixed EDs).

Methods: Prospective, observational study conducted in 36 Australian emergency departments (EDs) for 2 weeks in 2001. Children aged 1–15 years with acute asthma classified as mild or moderate severity. Details of demography, severity assessment, and type of treatment facility, treatment and disposition were collected. Analysis used descriptive statistics, comparison of proportions by χ^2 , and multiple logistic regression.

Results: Two-hundred and nine children were treated at POEDs and 257 at mixed EDs. The groups had similar severity. Spacers to deliver beta-agonists were used more frequently in POEDs (67.5% vs 24.2%; $P < 0.01$). Children treated at POEDs with a mild attack were more likely to be admitted (20.6% vs 9.5%; $P < 0.02$) and given salbutamol (82.8% vs 71.9%; $P = 0.03$). For children with moderate asthma, oral steroid prescription on hospital discharge was more common for those treated in a mixed ED (81.0% vs 95.7%; $P = 0.01$). Ipratropium bromide (IB) was widely used at both types of ED but more commonly used in mixed EDs (41.7% vs 54.9%; $P < 0.01$). There were no differences in length-of-stay, representation rate within one month and oral steroid use for attack. Less than 2/3 of children with mild asthma attacks received steroid treatment in the ED.

Conclusion: Treatment was similar between the two types of ED. IB was overused in mild asthma and oral steroids were underused in moderate asthma, by both ED types. Spacers were under-utilized in mixed EDs.

Key words: asthma; emergency presentation; paediatric; outcome; treatment.

Childhood asthma is very common in Australia with treatment for acute episodes commonly being sought from emergency departments (EDs) of public hospitals. In Australia, EDs treating children follow two different models. Most children will be treated in general emergency departments treating adults and children (mixed EDs), while a smaller number of children are treated in the emergency departments specializing in paediatric only emergency care with no adult component to the service (POEDs). Studies of other conditions have suggested that there is variation in practice between these treatment settings,^{1–4} but there are no data examining the management of asthma

Although there are clear national and international guidelines suggesting the treatment for acute asthma in children,^{5–7} it is well recognized that guidelines are not always followed whether in a paediatric setting or an adult setting.^{8–11} Indeed one study published over a decade ago from a paediatric-only ED examined 422 patients with acute asthma attending the department over a 12-month period. Only 30% of subjects were

given oral steroids for their attack. Discharge rate was 76% but only 29% were discharged with an oral course of steroids for completion at home.¹²

The objective of this study was to compare the management of paediatric patients with acute asthma in POEDs with treatment in mixed EDs and compare them to the contemporaneous National Asthma Campaign (NAC) guidelines for the management of acute asthma.¹³

METHODS

This prospective, observational study was conducted in 36 departments of emergency medicine in Australia for the period 20 August to 2 September 2001 as part of the *Snapshot of Asthma in Australia 2001* project. A detailed description of the *Snapshot of Asthma in Australia 2001* project methodology has previously been published.¹⁴ All EDs accredited for training by

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Accepted for publication 22 December 2003.

Participants and participating institutions (Paediatric only emergency departments in the study are in bold): Albury Base Hospital [Dr P. Love], Auburn Hospital [Dr G McNerney], Ballarat Base Hospital [Dr G Campaign], Bankstown Hospital [Dr L Dann], Box Hill Hospital [Dr L Pouw], Caboolture Hospital [Dr S Andrew-Starkey], Calvary Hospital [Dr M Ruigrok], Canterbury Hospital [Dr M Chu], Coffs Harbour Hospital [Dr A Tankel], Dandenong Hospital [Dr J Wenzel], Epworth Hospital [Dr A Yuen], Flinders Medical Centre [Dr T Elisizo], Fremantle Hospital [Dr J Hodge], Gold Coast Hospital [Dr D Green], Horsnby Ku-Ring-Gai Hospital [Dr R Day], Joondalup Hospital [Dr D Cruse], Launceston Hospital [Dr E Merfield], Lismore Base Hospital [Dr C Gavaghan], Mackay Hospital [Dr B Sadleir], Maroondah Hospital [Dr A Rosengarten], Mater Hospital [Dr J Holmes], **Mater Children's Hospital [Dr R Brady]**, Monash Medical Centre [Dr P Rosengarten], Port Macquarie Hospital [Dr J Roberts], **Royal Children's Hospital Victoria [Dr C Powell]**, **Royal Children's Hospital Queensland [Dr R Clark]**, Rockhampton Base Hospital [Dr H Hunt], Royal Darwin Hospital [Dr D Palmer], St Vincent's Hospital Sydney [Dr G Fulde], Sunshine Hospital [Dr C Powell], Sutherland Hospital [Dr J Raftos], Townsville Hospital [Dr N Small], Wagga Wagga Base Hospital [Dr S Curran], Western Hospital [Prof A Kelly], Wollongong Hospital [Dr A Bezzina], **Womens and Childrens Hospital South Australia [Dr J Raftos]**.

the Australasian College for Emergency Medicine were invited to participate in the study. The participating hospitals volunteered and data were collected locally. Data were collected by clinical staff at each hospital and entered onto a specifically designed form. Quality checks on the data were not performed. Data collected included demographic information, asthma severity as classified by the NAC,¹³ type of treatment facility (POED vs mixed ED), details of treatment and final disposition from the ED (home, ward, intensive care unit (ICU)). Data analysis was by descriptive statistics and comparison of proportions by χ^2 . Multiple logistic regression was performed using SPSS. A statistically significant result was considered as $P < 0.05$. This project was considered to be an audit or a survey in most centres involved and exempt from the requirement for ethics committee approval. Ethics committee approval was obtained for those centres where it was felt to be required.

We analysed data on all children aged between 1 and 15 years of age presenting with a physician-confirmed diagnosis of acute asthma and severity classification according to the NAC of mild or moderate severity,^{13,14} using the Snapshot of Asthma 2001 database. This age range was chosen to reduce potential overlap with bronchiolitis. We excluded children with severe asthma for the purpose of this analysis, as the numbers were too few ($n = 14$) for meaningful comparison.

RESULTS

A total of 466 cases were eligible for inclusion in this study (Fig. 1). 209 patients were treated in a POED and 257 in a mixed ED. Tables 1 and 2 illustrate the treatment and disposition in the two groups classified into mild and moderate attacks. Asthma severity and age were the similar in both centres. Of the sample, 56.8% were male. There were no statistical differences in length of stay, representation rate within one month and use of oral steroids in the ED. However, less than two thirds of children with mild asthma attacks received steroids treatment in the ED. Children who presented to mixed EDs with a moderate asthma attack were more likely to be prescribed oral steroids at hospital discharge (95.7% vs 81%; $P < 0.01$).

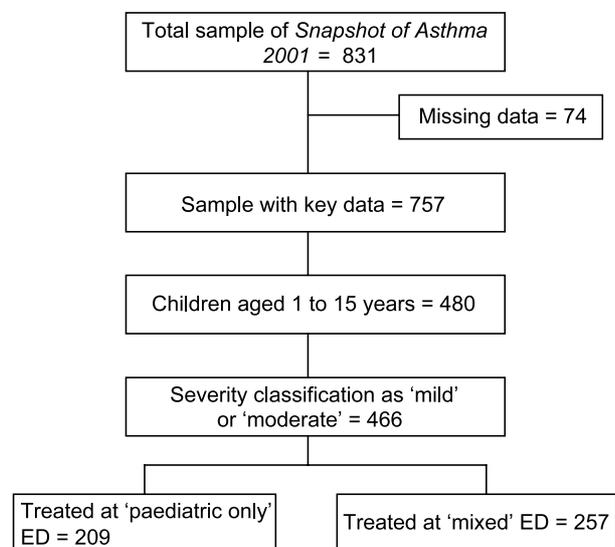


Fig. 1 Derivation of sample of *Snapshot of Asthma 2001*.

Spacers were used more frequently in POEDs compared to mixed EDs for both mild (83.3% vs 23.8%; $P < 0.001$) and moderate presentations (53.2% vs 24.5%; $P = 0.01$). Children treated at POEDs with a mild attack were more likely to be admitted to hospital (20.6% vs 9.5%; $P < 0.02$) and be given salbutamol (82.8% vs 71.9%; $P = 0.03$) but less likely to be administered oxygen (1.4% vs 18.2%; $P < 0.001$). Overall, Ipratropium bromide (IB) was widely used in both settings but more commonly used in mixed EDs (54.9% vs 41.7%; $P < 0.01$). No blood gases were taken from any child. One child with moderate asthma was given intravenous bronchodilators but no child received ventilatory support or admission to a high dependency or paediatric ICU. Chest X-ray rates were similar between ED types for both severity groups. Antibiotic use was appropriately low in both settings. After controlling for age, differences of ED for salbutamol use ($P = 0.03$) and admission to hospital ($P = 0.02$) remained statistically significant for children with mild asthma. Differences in spacer use remained statistically significant for both mild ($P < 0.001$) and moderate groups ($P = 0.001$).

DISCUSSION

Our data suggest that treatment of mild to moderate asthma in children is very similar whether they are treated in POEDs or mixed EDs and that generally, the treatment and disposition follow the NAC guideline.¹³ These findings agree with an American study which utilized questionnaire methodology where general emergency units were shown to have similar paediatric practice patterns when compared to paediatric only emergency settings.¹⁵

However there are clearly some differences between management in the two settings. It was surprising that children with mild asthma were more likely to be admitted when presenting to a POED. Although this study was not designed to explore this issue, several explanations are possible. There was a trend for the children presenting at POEDs to be younger than those presenting to mixed EDs, although this did not reach statistical significance. This may have lowered the threshold for admission. Access to inpatient beds may have been more difficult in a combined adult and paediatric hospital when compared to a paediatric only hospital. Parents presenting to a paediatric only hospital may have a higher expectation of requiring admission compared to those presenting to a mixed ED. This finding agrees with a previous study, which found that children who present at mixed EDs with general paediatric complaints were likely to be older and less likely to be admitted to hospital.¹⁶

Oral steroid use for acute asthma was under-utilized in both settings with only about two thirds of children presenting with mild asthma being given steroids. NAC suggests that oral steroids should be considered for mild asthma presenting at an ED.¹³ For moderate asthma there is no doubt about the recommendations and it is clearly underused in this group with 10–15% not receiving oral steroids. However, this is a great improvement from the study by Barnett and Oberklaid in 1991, where only 30% of all the patients seen in an ED over their study period received oral steroids.¹² It is reassuring that there was no intravenous steroid use in both settings and clearly no centre in this study is using intravenous bronchodilators in the less severe attacks.

Guidelines recommend that Ipratropium bromide (IB) use should be reserved to those with severe and life threatening and it is 'not necessary' for mild asthma and 'optional' for moderate asthma.^{5,13} It is clearly being overused in both settings for mild attacks with 30–40% of mild cases receiving IB. This

Table 1 Comparison of treatment given to children according to National Asthma Guidelines (1998) severity classification (mild)

Variables	Type of ED		P-value	Odds ratio
	Paediatric only Mild <i>n</i> = 145 (%)	Mixed Mild <i>n</i> = 161 (%)		
Age (years)				
1–2	42 (29.0)	30 (18.6)	ns	
3–5	37 (25.5)	37 (23.0)		
6–9	36 (24.8)	55 (34.2)		
10–15	30 (20.7)	39 (24.2)		
Oxygen	2/143 (1.4)	29/159 (18.2)	< 0.001	0.06 (0.02–0.27)
Salbutamol	120/145 (82.8)	115/160 (71.9)	0.03	1.88 (1.08–3.26)
	20 (16.7) nebulized	75 (65.2) nebulized	< 0.001	0.11 (0.06–0.20)
	100 (83.3) spacer	40 (34.8) spacer		
Ipratropium	43/142 (30.3)	63/159 (39.6)	ns	
	13 (30.2) nebulized	57 (90.5) nebulized	< 0.001	0.05 (0.02–0.13)
	30 (69.8) spacer	6 (9.5) spacer		
Steroids	88/142 (62)	84/158 (53.2)	ns	
Disposition	Home 112 (79.4)	Home 143 (90.5)	0.01	2.47 (1.26–4.83)
	Admitted 29 (20.6)	Admitted 15 (9.5)		
Steroids at discharge	93/145 (64) oral	100/159 (62.9) oral	ns	
	28/145 (19.3) inhaled	41/159 (25.8) inhaled	ns	
For patients discharged from the ED. Steroid prescription	74/112 (66.1)	97/143 (67.8)	ns	
	Both oral and inhaled 9	Both oral and inhaled 23		
	Oral only 58	Oral only 63		
	Inhaled only 7	Inhaled only 11		
Antibiotics at discharge	7/145 (4.8)	13/159 (8.2)	ns	
X-rays	15/141 (10.6)	16/159 (10.1)	ns	
Length of stay				
< 12 h	131/146 (89.7)	113/140 (80.7)	ns	
12–24 h	4/146 (2.7)	5/140 (3.6)		
1–2 days	8/146 (5.5)	16/140 (11.4)		
3–5 days	1/146 (0.7)	4 (2.8)		
> 5 days	2/146 (1.4)	2 (1.4)		
Representation	16/143 (11.2)	16/152 (10.5)	ns	

overuse has been described in the adult setting also.¹⁴ Clearly many units are opting to administer it in moderate asthma with 60–80% of children receiving IB in this study. Recent data suggest that IB is only effective in severe exacerbations when given in multiple doses and 'there is no conclusive evidence for using multiple doses of anticholinergics in children with mild or moderate exacerbations'.¹⁷

Spacer use is more likely in a POED setting. The current evidence supports the use in children,¹⁸ and has been successful in a number of paediatric settings,^{19,20} with evidence that morbidity, side-effects of treatment, time in the ED, admission rate and cost is reduced when acute asthma is treated with spacers as apposed to nebulizers.^{18,21,22} The adult data are not so persuasive suggesting that spacers work as well as nebulizers but there are less immediate benefits.¹⁸ It is thus not surprising that spacer usage is less in mixed EDs. With further dissemination and acceptance of spacer use across the emergency communities this may well change. This study found that investigation rates were similar between the two settings. This is at odds with findings from studies of other conditions. Hampers (2000) found a tendency towards more expensive evaluations of children with febrile convulsions in a mixed ED.¹ Petrack (1997) found that children presenting at mixed EDs might receive less adequate analgesia than those treated at POEDs.⁴ Issacman (1991) found differences in the way fever without a source is managed with children presenting to mixed EDs receiving more chest radiographs and lumbar punctures but less full blood counts, blood cultures and urinalysis compared to POEDs.³ In croup, rates of resource utilization were

higher in mixed EDs compared to units where physicians with a paediatric background practiced.²

This study has some limitations that should be considered when interpreting the results. Patient selection was based on physician diagnosis of asthma; no attempt was made to obtain pulmonary function data or other clinical data to help confirm the diagnosis. 20–30% of the mild asthma were not given salbutamol at presentation and this may call into question their diagnosis. This may also reflect the reliability of the data collection process. It may be that some of the children had very mild symptoms and it was considered not necessary to give them bronchodilators. While this approach may have resulted in the incorrect inclusion of some patients, it is a reflection of 'real world' practice in EDs and should not have introduced a systematic bias. There is a modest amount of missing data. Our findings may not be generalizable to other settings or systems. The hospitals that participated elected to do so voluntarily; they may represent departments whose leaders have a keen interest in asthma management or those where staff generally have a higher level of training. We were not able to compare the management of severe asthma due to low patient numbers. It is possible that practice variation is greater in this group. No data were collected about the training of the doctors in either setting. It is possible that not all children with a presentation of acute asthma during the study period were included in the study by participant hospitals, but the numbers are likely to be small. Despite these limitations, the authors believe that the study is representative of treatment patterns in Australian hospitals.

Table 2 Comparison of treatment given to children according to National Asthma Guidelines (1998) severity classification (moderate)

Variables	Type of ED		P-value	Odds ratio
	Paediatric only Moderate n = 64 (%)	Mixed Moderate n = 96 (%)		
Age (years)				
1–2	34 (53.1)	36 (37.5)	ns	
3–5	19 (29.7)	27 (28.1)		
6–9	7 (10.9)	15 (15.6)		
10–15	4 (6.2)	18 (18.7)		
Oxygen	27/62 (43.5)	50/92 (54.3)	ns	
Salbutamol	62/64 (96.9)	94/95 (98.9)	ns	
	28 (45.2) nebulizer	71 (75.5) nebulizer	< 0.001	0.26 (0.14–0.55)
	33 (53.2) spacer	23 (24.5) spacer		
Ipratropium	43/64 (67.2)	76/94 (80.9)	ns	
	26 (60.5) nebulizer	63 (82.9) nebulizer	0.01	0.32 (0.13–0.74)
	17 (39.5) spacer	13 (17.1) spacer		
Steroids	54/64 (84.4)	85/95 (89.5)	ns	
Disposition	Home 20 (31.3)	Home 37 (38.5)	ns	
	Admitted 44 (68.7)	Admitted 59 (61.5)		
Steroids at discharge	51/63 (81) oral	90/94 (95.7) oral	< 0.001	0.19 (0.06–0.62)
	9/63 (14.3) inhaled	23/94 (24.5) inhaled	ns	
For patients discharged from the ED. Steroid prescription	15/20 (75)	32/37 (86.5)	ns	
	Both oral and inhaled 1	Both oral and inhaled 4		
	Oral only 14	Oral only 28		
	Inhaled only 0	Inhaled only 0		
	Neither 5	Neither 5		
Antibiotics at discharge	4/63 (6.3)	9/94 (9.6)	ns	
X-rays	10/61 (16.4)	24/96 (25)	ns	
Length of stay				
< 12 h	18/62 (29)	36/92 (39)	ns	
12–24 h	9/62 (14.5)	14/92 (15.2)		
1–2 days	27/62 (43.5)	32/92 (34.8)		
3–5 days	7/62 (11.3)	10/92 (10.9)		
> 5 days	1/62 (1.6)	0/92 (0)		
Representation	13/62 (21)	12/92 (13)	ns	

CONCLUSION

Overall adherence to the NAC guidelines¹³ in both environments was good and similar. There were the notable exceptions of under use of spacers, and generally there was overuse of ipratropium bromide in milder asthma and under use of steroids in both settings in the moderate group. Admission rate was higher in the POEDs for milder asthma and the reasons for this need to be explored further.

ACKNOWLEDGEMENTS

This study was supported by a grant from the Commonwealth Department of Health and Aged Care (Australia). The authors would like to thank their colleagues who participated in *Snapshot of Asthma 2001*.

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