

Successful implementation of evidence-based guidelines in a regional emergency department for children presenting with acute asthma

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Abstract

Objective: To evaluate the adherence to asthma evidence-based guidelines before and after a quality improvement process.

Design: A controlled trial was conducted at two regional hospitals (intervention and control hospitals). We performed a retrospective pre-intervention audit, followed by a post-intervention audit 1 year after the implementation of evidence-based guidelines.

Setting: Emergency departments of two neighbouring hospitals serving regional and rural North West Tasmania.

Participants: All children (<18 years) with acute presentation of doctor-diagnosed asthma.

Interventions: Implementation of evidence-based guidelines using the National Asthma Council of Australia and the Global Initiative of Asthma guidelines, at the intervention hospital and care as usual at the control hospital.

Main outcome measure(s): The main outcome measures were the compliance to evidence-based guidelines, pre- and postintervention at the intervention hospital, compared to the control hospital. The specific outcomes measure included the clinical presentation, management, referral to asthma and allergy clinic, and hospitalisation.

Results: Significantly improved adherence to evidence-based guidelines were noted post-intervention at the intervention hospital, that is severity recorded (21.4%-45.7%, $P < 0.001$), triggers identified (13.5%-45.3%, $P < 0.001$), spirometry usage (3.8%-25.8%, $P = 0.03$) and written action plans (29.7%-58.3%, $P < 0.001$). There was however no effect on hospitalisation (23.3%-29.8%, $P = 0.48$). At the control hospital, however, no significant improved adherence to evidence-based guidelines were noted.

Conclusions: Evidence-based implementation led to improved adherence to evidence-based guidelines across an expanded list of domains in a regional setting.

KEYWORDS

clinical, paediatric, respiratory, rural, standards

1 | INTRODUCTION

Asthma affects about 300 million people worldwide and is the most common long-term medical condition in children.^{1,2} Hospital admissions for asthma have continued to increase globally, especially among children.² In Australia, asthma affects approximately 2 million people (10% of the population),³ and is considered a national health priority.⁴ It is also the most common reason for hospitalisation among children. In a local Tasmanian study, we reported a prevalence of asthma higher than the national average in young children.⁵

Outer regional, rural, lower socio-economic status and Aboriginal and Torres Strait Islander people are disproportionately affected by asthma.³ North West Tasmania represents such an area, which is predominantly an inner regional area with an average socio-economic status lower than the national average.⁶ Family practitioners are generally the primary caregivers for children with asthma, representing approximately 4.5% of all patient encounters.⁷ Acute asthma is the fourth most common presentation to major Australian paediatric emergency departments (EDs).⁸ Also, 10% of asthmatics reported at least one ED visit in the previous year.⁹ We therefore expect ED childhood asthma will remain a common presentation. This is of particular relevance in North West Tasmania with fewer general practitioners per population compared to the national average.⁶

Evidence-based guidelines (EBG) provide clinicians with up to date guidance and set the standard for the management of asthma. International guidelines, published by the Global Initiative for Asthma (GINA), and Australian guidelines published by the National Asthma Council of Australia (NACA) are updated on a regular basis. Improved adherence to EBG in the ED reduces ED length of stay, hospital length of stay and Intensive Care Units (ICU) admissions.¹⁰ However, despite clinicians having a knowledge of the guidelines, the implementation remains suboptimal.¹¹ In Australia one in three patients with uncontrolled asthma did not use a preventer at all,⁹ and less than a quarter of children had a written asthma action plan.³ In an earlier study representing a similar regional ED in Australia, Doherty et al¹² reported significant gaps in evidence-based care in regional New South Wales EDs. In a local hospital audit, we have similarly identified gaps in evidence-based care in children attending a regional ED in North West Tasmania (unpublished data). Quality improvement (QI) is a process undertaken to enhance the care where gaps have existed. Doherty et al¹² describe a QI intervention in a regional ED that resulted in improved adherence to EBG across five domains only, that is documentation of severity, spirometry usage, spacer usage, reduction in ipratropium bromide in mild asthmatics and the increased use of short term asthma management plans. The impact of a QI process across an expanded list of EBG measures in regional paediatric asthma care has not been well studied.

What is already known on this subject:

- Asthma is a common reason for presentation to emergency departments and the commonest reason for admission to hospital in childhood.
- International and national evidence-based asthma guidelines are widely distributed, yet adherence remains suboptimal.
- Few studies report on the successful implementation of evidence-based paediatric asthma guidelines in regional hospitals.

What this study add:

- Adherence to evidence-based guidelines can be successfully improved in children with asthma presenting to a regional emergency department.
- It remained difficult to achieve improved asthma and allergy clinic referral, and lung function testing.
- The implementation of evidence-based guidelines had no effect on asthma emergency department representation or hospitalisation.

We aim to study the impact of a QI process on the adherence to paediatric asthma EBG across an expanded list of indicators in a regional ED.

2 | METHODS

2.1 | Pre-intervention

A pre-intervention audit was performed at the ED of two regional hospitals in North West Tasmania. Information was obtained from clinical records (ie, both paper-based and electronic-based records of all children [≤ 18 years]) with acute asthma (doctor diagnosed) presenting to the ED over a 1-year period (1 November 2009 - 31 October 2010). Participants were identified by their ICD9 codes and all information was entered on a data capture sheet in a de-identified manner.

The two hospitals are based in North West Tasmania, which together serve a population of 101 195 people, with the 0 to 14-year old age group representing about a quarter of the population.⁷ The ED has approximately 10 000 presentations per annum, about 3000 paediatric presentations with acute asthma being a common presentation.

2.2 | Intervention

Following the pre-intervention audit, EBG were implemented only at the intervention hospital, while at the neighbouring control hospital patients received care as usual. This QI process was led by a paediatric consultant with specialist experience

in respiratory and allergy, supported by a clinical nurse consultant. The hospital management fully supported this initiative. The interventions, as outlined in Table 1, were based on the framework of the NACA and GINA guidelines.^{13,14}

Together, the following QI steps were implemented:

- Assembled a skilled team with a shared vision (the core team included the paediatric consultant, two paediatric nurses and an adult respiratory nurse),
- Shared current gaps in EBG with team (pre-implementation audit),
- and identified solutions and discussed the improvement theory.

The core team obtained additional training which included:

- Lung function training: NACA lung function workshop (included paediatric medical staff).
- Allergy skin prick testing training: allergy trained nurse provided training and ASCIA allergy skin prick test protocol introduced.
- Asthma and allergy education: paediatric nursing and medical staff attended Asthma Foundation workshop; clinical nurse consultant completed a 12-month post-graduate allergy certificate.
- Self-management training: Flinders' Self-Management Workshop.
- Standardised work practices introduced to ensure EBG implemented in standardised fashion as part of usual care, for example completion of asthma control test (ACT) prior to consult.
- Networks established with organisations, such as Asthma Australia.
- Patient educational resources sourced.

Furthermore, we developed a paediatric asthma electronic database as outlined in Table 1, with the goal of organising the asthma clinic more effectively.

2.3 | Post-intervention

The post-intervention data, as outlined in Table 2, were collected retrospectively from clinical case and electronic records for 1 year after the implementation of EBG, that is 1 November 2011 until 31 October 2012. All data were collected by the clinical nurse consultant and two medical students.

2.4 | Statistics and ethics

Data were entered into a Microsoft Excel spreadsheet (Microsoft Corp.) and Stata 12.1 (Statcorp) software used for statistical analysis. Chi-squared test was used primarily for statistical analyses and Fisher's exact test was used where at

TABLE 1 Goals in evidence-based care for children presenting with acute asthma and instruments used in this study

Evidence-based care goals	Instrument implemented
Assess severity	Symptom assessment Lung function testing
Identify and avoid triggers	Routine questionnaire (developed during implementation phase) Allergenic triggers identified with allergy skin prick testing Smoking history obtained
Effective management	Develop partnership with aim to improve self-management (Flinders Self Management training) ^a Written asthma action plan Education (nurse educator)
Maintain control	Referral to newly established paediatric asthma clinic for follow up visits Asthma control test ^b (>4 y of age): 4-11 y old: (Childhood -asthma control test (C-ACT) 12 y and above asthma control test (ACT) Optimise lung functions
Organise asthma clinic effectively	Asthma clinic led by paediatrician and clinical nurse consultant Patient resources (Asthma Foundation and NACA) Computerised asthma register: • database of all asthma patients • identify patients requiring review • tracking control and adequacy of treatments • generates automated discharge letter

Note: Based on NACA 2006 and Global Initiative for Asthma (GINA) 2009 guidelines.

Abbreviation: NACA, National Asthma Council of Australia.

^aAvailable from: <https://www.flindersprogram.com.au>.

^bAvailable from: <https://www.asthma.com/>.

least one expected cell value was <5. *P* values <0.05 were considered significant.

2.5 | Ethics approval

The study was approved by the Human Research Ethics Committee of the University of Tasmania (Reference number H0013578) and the Clinical Trials Committee of the Tasmanian Health Service - North West.

3 | RESULTS

Table 2 outlines the profile of children with acute asthma who presented to the intervention and control EDs during the pre- and post-intervention time periods. We noticed similar

TABLE 2 Comparison of paediatric asthma presentations to an intervention and control regional emergency department following the adoption of asthma best-practice guidelines

	Control hospital			Intervention hospital		
	Time period 1	Time period 2	<i>P</i> -value	Time period 1	Time period 2	<i>P</i> -value
Total	112	71		104	72	
Sex: M:F, n (%)	84:28 (75:25)	40:31 (56.3:43.7)	0.10	62:42 (59.6:40.4)	43:29 (59.7:40.3)	0.99
Median age, years (IQR)	6.1 (3.2, 11)	4.5 (2.7, 6.9)		6.2 (3.9, 9.4)	5.3 (3.1, 10.8)	
Severity recorded	32 (28.8)	14 (19.7)	0.17	21 (21.4)	32 (45.7)	0.001
Triggers identified	59 (53.2)	41 (57.8)	0.54	14 (13.5)	29 (45.3)	<0.001
Smoke exposure	7 (6.3)	4 (5.7)	0.87	14 (13.6)	17 (31.5)	0.007
Comorbidities	33 (29.7)	18 (25.4)	0.52	37 (36.3)	38 (53.5)	0.02
Inhaler technique	2 (1.8)	2 (2.9)	0.32	22 (21.8)	32 (45.1)	0.001
Asthma control test	1 (0.9)	0 (0)	0.42	1 (1.0)	7 (12.3)	0.002
Paediatric asthma clinic referral	23 (20.7)	14 (19.7)	0.87	24 (23.1)	30 (44.8)	0.003
Allergy clinic referral	3 (2.7)	0 (0)	0.16	22 (21.5)	19 (29.2)	0.233
PEF (≥ 6 y)	3 (5.4)	0 (0)	0.25	5 (5.0)	6 (17.6)	0.02
LFT (≥ 6 y)	5 (8.9)	2 (9.1)	0.98	2 (3.8)	8 (25.8)	0.03
Oral corticosteroids	92 (82.9)	64 (91.4)	0.10	93 (93.0)	60 (83.3)	0.24
WAAP	33 (29.7)	14 (19.7)	0.14	30 (29.7)	42 (58.3)	<0.001
First emergency departments presentation	75 (67.6)	65 (91.6)	<0.01	43 (44.8)	49 (69.0)	0.02
Hospitalisation	31 (27.9)	22 (31.0)	0.63	24 (23.3)	20 (29.8)	0.48

Note: Percentages reported in brackets, except for interquartile range reported for median age.

Abbreviations: CS, corticosteroids; F, Women; IQR, interquartile range; LFT, lung function tests; M, Men; PEF, peak expiratory flow rate; WAAP, Written Asthma Action Plan.

reduction in ED presentations across both hospitals in time period 2 (intervention: 30.8% and control: 36.6% reduction). A predominance of boys were noted throughout. In the post-intervention period the cohort was younger, but this did not reach statistical significance.

There were improvements in all domains at the intervention hospital post-intervention (Table 2), except for the proportions of those referred to the Paediatric allergy clinic (before 21.5% vs after 29.2%, $P = 0.23$) and requiring hospitalisation (before 23.3% vs after 29.8%, $P = 0.12$). No improvements were noted at the control hospital, except that more children had single presentations to ED in the post intervention period (before 67.6% vs after 91.6%, $P < 0.01$). No significant changes were noted with regard to oral corticosteroid usage. Gaps in evidenced care still existed at the intervention hospital in time period 2, that is smoking history (31.5%), ACTs (12.3%), lung functions in eligible patients (peak expiratory flow rate 17.6% and spirometry 25.8%), referral to asthma clinic (44%) and allergy testing referral (29.2%).

In the pre-intervention period, there was however good adherence to certain EBG, that is regular oral corticosteroid (>80%), limited antibiotics, limited ipratropium bromide usage.

4 | DISCUSSION

We demonstrated that the implementation of EBG in children with acute asthma presenting to a regional ED resulted in improved adherence to EBG across an expanded list of indicators, compared to the control hospital where patients received care as usual.

4.1 | Evidenced based guidelines

Despite the known benefits of adherence to EBG, significant gaps in the implementation of such guidelines remain both nationally and internationally. For example, in a large Canadian study which has a similar health care system to Australia, only 18% of asthmatics used inhaled corticosteroids and 12% had a follow-up visit.¹⁵ In a similar ED study in a regional Australian hospital, comparable challenges were reported, for example severity was recorded in 8% (current study: 18%-21%) and written asthma action plans used in 0%-9% (current study: 30%-33%).¹⁶ The overall improved adherence to EBG in the baseline period could be due to our study being performed 5 years later, during this time appropriate asthma management has received much attention. Spirometry usage was equally low in both studies (New

South Wales: 2%-12%, Current: 4%-9%). The low usage of lung function testing in asthma management could potentially lead to a misdiagnosis in up to 50% of cases.¹⁷ There was however good adherence to the following EBG: no over-prescription of antibiotics in afebrile patients, no overuse of ipratropium bromide in mild asthma patients and underutilisation of systemic corticosteroids was not observed.

4.2 | Quality improvement process

We successfully implemented a QI process in a resource-limited setting. We believe that a major driving force to the intervention's success was the clinical leadership, driven by a paediatrician and clinical nurse consultant, with the full support of the organisation's management.⁴ The importance of leadership in a QI process has been well documented. Our first step was to define the practice gaps in acute asthma care in our setting and the collection of systematic data, which also led us to establish an ongoing electronic database. Doherty et al¹⁶ have shown improved compliance with evidence-based asthma guidelines across few key asthma indicators in a similar rural setting. In the current study, we show improvements across an expanded list of indicators at the intervention hospital only. However, opportunities for further improvements remain as only a quarter of patients accessed lung function testing and just under half were referred to a Paediatric Asthma Clinic. The hospitalisation rates were, however, unchanged at both hospitals. This finding is consistent with a large Canadian population-based study and a local Australian study which similarly showed no effect on hospitalisation rates, return to ED or follow-up visits.^{18,19} This is further in keeping with a systematic review which showed no difference in number of ED visits in 34 reported studies after the implementation of a variety of QI interventions.²⁰ Overall, we show improved childhood asthma care can be achieved over a relatively short implementation period in a regional ED.

4.3 | Barriers

We identified barriers to the implementation of EBG, such as the rapid turnover of medical staff, accessibility of lung function testing, lower literacy and lower SES in North West Tasmania. Additional potential barriers include lack of familiarity, patient-related factors, external factors related to environment, which varies according to local circumstances.²¹ In response, both GINA and NACA have created a toolbox that identifies barriers and facilitators of evidence-based asthma care.^{4,22} In our study only half of patients were referred to a paediatric asthma or allergy clinic, similar to a large Canadian study where only 32% had follow-up outpatient visits after ED presentations with acute asthma.^{4,23} This could potentially be attributed to the rapid turnover of staff and a locum medical workforce. Guidelines suggest early follow-up within 2-4 days

of the acute asthma attack result in better adherence. Scope for further improvements exist, that is the need for improved referral system to the asthma/allergy clinic and the performance of lung function tests when indicated.

4.4 | Study strengths and limitations

The retrospective nature of this study has known limitations. Although clinical information was entered in standardised case report forms, source information obtained from clinical records was not entered in a standardised manner. Another limitation was that the diagnosis of asthma could not be established reliably as it was doctor-based, and not always based on objective criteria. Also, the improved EBG remain as only surrogate measures for clinical outcomes. A key strength was the inclusion of a control hospital as the reduction in ED presentations in the post-intervention period could otherwise have been attributed to the intervention. Similar to the findings of a systematic review, it is not evident which QI measures were most effective.¹⁹ Improvement measures which included self-management strategies and patient education appeared to be most effective.

5 | CONCLUSION

In conclusion, we show the successful introduction of a QI process resulting in an improved adherence to asthma EBG in children presenting to a regional ED.

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CONFLICT OF INTEREST

None.

DISCLOSURE

None.

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