

Implementation of evidence based guidelines for paediatric asthma management in a teaching hospital

J Massie, D Efron, B Cerritelli, M South, C Powell, M M Haby, E Gilbert, S Vidmar, J Carlin, C F Robertson, on behalf of the ICAAM Study Group

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See end of article for authors' affiliations

Correspondence to:
Dr J Massie, Department of Respiratory Medicine, Royal Children's Hospital, Flemington Road, Parkville, Victoria 3052, Australia; john.massie@rch.org.au

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Aims: To evaluate a systematic approach to the development and implementation of evidence based asthma management guidelines.

Methods: Comparative study of children (2–18 years) with acute asthma; a control cohort (cohort 1) was recruited before implementation of the guidelines and two cohorts were recruited after implementation (cohorts 2 and 3).

Results: There was no difference in the proportion of patients who reattended in the six months following initial presentation for cohort 1 (21.5%), cohort 2 (27.8%), or cohort 3 (25.4%) and no difference in readmission rates (11.4%, 11.3%, 11.0% respectively). There was no difference in measures of asthma morbidity between the cohorts at 3 and 6 months across three domains: interval symptoms, exercise limitation, and bronchodilator use. Of those who did not have a management plan before presentation, one was provided to 46.9% of cohort 1, 74.8% of cohort 2, and 81.1% of cohort 3. There was no difference comparing cohort 2 or cohort 3 with cohort 1 regarding quality of life for either the subjects or their parents.

Conclusions: Implementation of our evidence based guidelines was associated with the improved provision of asthma management plans, but there was no effect on reattendance or readmission to hospital, asthma morbidity, or quality of life. Future efforts to improve asthma management should target specific components of asthma care.

Asthma remains the most common medical cause for admission to paediatric hospitals and the rate of reattendance and readmission is high.¹ There is evidence that reattendance and readmission rates could be improved with a coordinated, evidence based asthma management programme within a teaching hospital and in its links to the community.² Optimal self management for adults, including a written action plan, reduced hospital admissions by 42% and emergency department visits by 22%.² Nurse led programmes have had similar success in reducing rehospitalisation in school age children,^{3 4} but have been less successful in preschool children.⁵ These interventions could be incorporated into global asthma practice guidelines for hospitals, but whether patient outcomes are improved is unknown.

Clinical practice guidelines can facilitate translation of research into routine practice by altering physicians' attitudes and practice.⁶ Guideline success, however, is measured by improvement of patient outcomes.⁷ Evidence based guidelines for asthma management have been developed at national and international levels with revisions made incorporating new evidence and changing clinical practice.^{8–11} Despite the availability of these guidelines we identified significant gaps between current management and best practice in children attending our institution.¹² The likely explanation is that there has been focus on guideline development with little attention to implementation.¹³ There is little evidence for the positive effect of guideline creation alone.¹⁴ The maximum effectiveness of clinical guidelines occurs when development and implementation result from a coordinated, collaborative, and interactive process.^{6 14 15} Ideally national and international guidelines should be adapted to local settings with local ownership of the recommendations in association with an organised implementation programme.¹⁶

The aim of this study was to evaluate a systematic and coordinated approach to the development and implementation of evidence based asthma management guidelines for a paediatric hospital.

METHODS

Study design

This was a comparative study with a baseline cohort (cohort 1) recruited before guideline development. A second cohort was recruited to assess the effectiveness of implementation (cohort 2) and a third cohort was recruited one year later to assess the sustainability of changes (cohort 3). Eligible participants were children 2–18 years of age presenting to the Royal Children's Hospital, Melbourne (RCH) emergency department with acute asthma. Cohort 1 was recruited between June and October 1999, cohort 2 between April and August 2000, and cohort 3 between January and May 2001. We excluded children without an English speaking parent/carer and those unable to complete the questionnaire. The primary outcomes were rates of reattendance and readmission to RCH, a change in asthma morbidity, and quality of life.

Asthma best practice guidelines

The RCH Asthma Best Practice Guidelines were developed by a collaboration of opinion leaders in asthma care from medical, nursing, and allied health. Relevant components of national and international asthma guidelines were reviewed. Literature searches using the Cochrane Database of Systematic Reviews and Database of Controlled Trials, Medline, and Embase identified relevant systematic reviews and randomised controlled trials. ICAAM members submitted

Abbreviations: ICAAM, improving child and adolescent asthma management; RCH, Royal Children's Hospital

contributions from their area of expertise, recommendations were debated, and evidence levels were assigned.¹⁵ Draft guidelines were distributed to relevant departments for review before final release. The guidelines included all aspects of acute and outpatient care and can be viewed at http://www.wch.org.au/clinicalguide/pages/asthma_bpg.php.

Asthma best practice guideline implementation

The Asthma Best Practice Guidelines were launched in October 1999, at a specially convened grand round, a seminar for paediatricians, two nursing forums, emergency department forum, and a junior medical staff workshop. The guidelines were published on the hospital intranet and a printed summary version of the key recommendations was distributed to relevant medical, nursing and allied health staff.

The focus of implementation was based on gaps in current practice which had been identified in a previous study at RCH and by consensus of the ICAAM working group and identified as key recommendations.¹² These included: assessment of asthma severity, nurse assessment of patient improvement, individualised asthma management plan, discharge letter and management plan sent to the general practitioner, and newly diagnosed patients referred for paediatrician follow up. A multidisciplinary Asthma Special Interest Group convened monthly to discuss asthma care (hospital and community based) with emphasis on the guidelines.

To facilitate the changes to practice two senior doctors conducted small group tutorials for nurses and junior doctors. An experienced nurse was recruited for the implementation phase (and subsequently a senior nurse from each ward) to oversee the changes to practice. A computer based asthma education programme was developed to educate staff about the key changes to in-patient care.

Paperwork for the documentation of clinical progress and treatment of asthma patients was upgraded and acted as a prompt to best practice recommendations.

Communication with general practitioners was assisted by a computer based discharge pack (letter, management plan, follow up, education, inhaler technique, and prednisolone prescription).

Measures

Computerised hospital records were used to calculate readmission and reattendance at RCH within six months of initial presentation. All asthma presentations during the recruitment and follow up phases were included as all patients were universally affected by guideline implementation and the measure was independent of participation in the study.

Four purpose designed questionnaires were completed by the child's parents/carers. Questionnaire 1 was given during the acute attendance and collected information on the asthma history (including a pre-existing asthma management plan) and quality of life over the previous three months, and the severity and pattern of asthma over the previous 12 months. The questions relating to asthma severity (morbidity, exacerbations) were based on questions from pre-existing questionnaires,¹⁷ and the quality of life measures was by Juniper.¹⁸ Parent perceptions of treatment given at RCH and provision of an asthma management plan was recorded by questionnaire 1a which was posted two weeks after admission. The subsequent course and quality of life were assessed with questionnaires 2 and 3, posted to families 3 and 6 months respectively following the acute presentation.

For analysis participants were grouped according to their pattern of asthma. Participants were defined as having: persistent asthma if they experienced symptoms more than one night or day per week on a regular basis; frequent

episodic asthma if they experienced symptoms less than once per week *and* had more than four attacks in the preceding 12 months; and infrequent episodic asthma if they experienced symptoms less than once per week *and* had fewer than four attacks in the preceding 12 months.

Statistical analysis

We planned to recruit 400 children in each cohort on the basis that this would provide 80% power for detecting a reduction in reattendance to the emergency department of 10% and readmission to hospital of 15% at the two sided 5% significance level.

Data were analysed using Stata (version 7.0, Stata Corporation, College Station, Texas, USA). Age was summarised as means for each cohort while all other demographic variables were summarised as percentages. Outcome variables were ordinal measures and summarised as percentages in their ordinal form. These variables were also dichotomised and logistic regression analysis was used in order to estimate odds ratios with adjustment for baseline differences between the cohorts. For all outcome variables, except those related to symptoms between attacks, the pattern of asthma was adjusted for (as a baseline severity indicator) in the logistic regression analysis.

The study was approved by the RCH Ethics in Human Research Committee (Study 99022B).

RESULTS

The number of eligible and included participants for each cohort is presented in table 1 and baseline characteristics are presented in table 2.

Reattendance and readmission to hospital

There was no statistically significant difference in the proportion of patients who reattended the emergency department in the six months following initial presentation during the recruitment periods for cohort 1 (21.5%), cohort 2 (27.8%), or cohort 3 (25.4%). Similarly, there was no difference in readmission rates (11.4%, 11.3%, 11.0% respectively).

Analysis of follow up questionnaires

We analysed the three and six month follow up questionnaires for each cohort and compared them with the baseline questionnaire. There were minimal differences between the three and six month responses so only the data at three months are reported here.

There were no differences in measures of asthma morbidity at three months across three domains: interval symptoms (see tables 3 and 4), exercise limitation and bronchodilator use, comparing cohort 2 with cohort 1 and cohort 3 with cohort 1.

In cohort 1, 36.6% of subjects had a management plan prior to presenting to the emergency department compared with 42.1% in cohort 2 ($p=0.07$) and 37.5% in cohort 3

Table 1 Summary of eligible and included participants in the study

	Cohort 1	Cohort 2	Cohort 3
Eligible*	637	642	717
Refused at onset/did not complete questionnaire 1 or 1A	153	163	274
Did not complete questionnaires 2 and 3	110	116	66
Total no. analysed	374	363	377

*Eligible subjects were aged 2–18 years of age presenting to the RCH emergency department with acute asthma, who had an English speaking parent/carer, and who were able to complete the questionnaires.

Table 2 Baseline characteristics of the three cohorts

Demographics	Cohort 1 (n=374)	Cohort 2 (n=363)	Cohort 3 (n=377)
Age (in years, mean)	6.1	6.0	5.9
Sex (male)	% 63.1	% 62.8	% 61.0
Asthma severity			
Persistent asthma	49.7	44.2	38.9
Frequent episodic asthma	15.8	13.0	12.0
Infrequent episodic asthma	34.5	42.8	49.1
Attacks in past 12 months			
No attacks	21.8	19.7	30.8
1–3 attacks	37.6	45.5	40.5
4–12 attacks	32.5	27.2	23.6
>12 attacks	8.1	7.6	5.1
Admissions to hospital in past 12 months			
No admissions	71.1	72.0	80.8
1–3 admissions	27.0	26.3	17.8
4–12 admissions	1.9	1.7	1.4

Differences in the cohorts at baseline are accounted for using regression analyses for the comparisons of interest.

($p=0.4$). Of those who did not have a management plan before attending RCH, one was provided to 46.9% of cohort 1, 74.8% of cohort 2 ($p<0.001$), and 81.1% of cohort 3 ($p<0.001$).

There was no difference comparing cohort 2 or cohort 3 with cohort 1 regarding parent and child quality of life measures. The key elements of days of missed school (child >5 years), days of missed work (parent), or limitation of social activities (child/parent) are presented in table 5.

DISCUSSION

The implementation of evidenced based asthma guidelines in our teaching hospital made no difference to readmission to hospital, reattendance at the emergency department, asthma morbidity, and quality of life. We did show an improvement in provision of asthma management plans. From these

Table 3 Asthma morbidity measures at three month follow up

Interval symptoms	Morbidity		
	Cohort 1 %	Cohort 2 %	Cohort 3 %
Waking with symptoms at night			
Never	38.5	41.1	42.6
Less than one night per week	37.5	40.9	37.3
1–3 nights per week	18.1	13.8	15.8
More than 3 nights per week	5.9	4.2	4.3
Waking with symptoms in the morning			
Never	35.4	38.1	39.7
Less than one night per week	39.0	37.0	37.5
1–3 nights per week	18.2	18.4	16.6
More than 3 nights per week	7.4	6.5	6.2
Symptoms during the day			
Never	28.3	30.5	29.4
Less than one night per week	41.0	42.9	42.8
1–3 nights per week	22.8	19.5	19.6
More than 3 nights per week	7.9	7.1	8.2
When playing sport/activity			
Never	33.4	32.5	33.9
Less than one night per week	32.9	37.6	39.3
1–3 nights per week	24.2	21.2	18.1
More than 3 nights per week	9.5	8.7	8.7

findings, there are important lessons to learn about asthma guideline development and implementation.

The failure of asthma management guidelines to influence patient outcomes has a number of possible causes. It may represent the failure of guidelines generally to influence clinical practice or it may be a specific problem with asthma guidelines that have to cover so many dimensions of management. Our implementation strategies may not have influenced staff to follow the guidelines or it may have been that patients did not adhere to the recommendations. Alternatively, we may have influenced staff and patient adherence to the guidelines, but the recommendations did not make a substantial difference to asthma outcome.

The strategies that were implemented to improve asthma management were so wide ranging that it was not possible to design a randomised controlled trial, and so a before and after study design was used. In this regard the subjects in cohort 1 were technically speaking, historical controls. A small number of these controls were also enrolled in the later two cohorts; however, there were so few of these that it did not affect the overall result. It is also possible that the negative outcome from the study was a failure of our measuring instrument to detect any improvement in asthma management.

The principles for the development and implementation of clinical guidelines have been well described and we endeavoured to follow them.^{15–16} These include generation of an evidenced based document by a group of clinicians who can influence change (opinion leaders) and wide consultation before final release.¹⁹ Attributes of the guidelines that may influence their use include: specific recommendations, recommendations that are not controversial, and demand minimal change while taking into account local circumstances.^{20–21} Knowledge that the guidelines exist along with free access and an easy to read summary version have been proposed to improve guideline use.¹⁶ The identification of local champions to promote their use in routine practice have been acknowledged as important strategies.²² Dissemination of guidelines through active educational interventions such as workshops have proven successful.²¹ Provision of prompts to best practice on paperwork and through information technology links has been shown to help.²¹

We developed a thorough and evidence based guideline in a collaborative and interactive way that gave ownership of the guidelines to the staff involved in asthma care at our institution. We adapted existing guidelines to our local environment, providing levels of evidence for the recommendations. The recommendations were clearly stated and not controversial. Opinion leaders from the departments treating children with asthma were involved in the guideline development and discussed the recommendations with members of their departments. In this regard, we believe that our guidelines were developed in accordance with the recommendations discussed above.

It is possible that the failure of the guidelines to make a difference to patient outcomes was due to our implementation strategy. We endeavoured to reach all relevant staff through electronic, paper and face-to-face means. We believe that asthma management by nursing staff and junior medical staff was improved through our workshops, ward based local champions, use of the computerised education programme, prompts to best practice on the hospital paperwork, and computerised discharge pack. These interventions followed implementation recommendations but mainly related to the acute management in hospital. We may have had less effect on the practice of senior staff who are more likely to be involved with outpatient care. There are limited opportunities to access senior staff and to influence their practice. This remains a challenge for future implementation studies.

Table 4 Estimated odds ratios for more frequent symptoms of asthma morbidity at three month follow up

Symptoms between attacks	Morbidity			
	Cohort 2 v cohort 1		Cohort 3 v cohort 1	
	Odds ratio (95% CI)	p value	Odds ratio (95% CI)	p value
Waking with symptoms at night*	0.8 (0.5 to 1.2)	0.2	1.0 (0.8 to 1.2)	0.7
Waking with symptoms in the morning*	1.2 (0.8 to 1.8)	0.3	1.0 (0.9 to 1.3)	0.6
Symptoms during the day*	0.9 (0.6 to 1.3)	0.5	1.0 (0.9 to 1.3)	0.7
When playing sport/activity*	0.9 (0.6 to 1.2)	0.4	0.9 (0.7 to 1.1)	0.2

*Variables were dichotomised for odds ratios. "Never" + "less than one day/night per week" were combined and "1-3 days/nights per week" + "more than 3 days/nights per week" were combined.

We have previously facilitated the transition from delivery of bronchodilators in acute asthma from nebulisers to metered dose inhaler and spacer at our institution.²³ This represents one aspect of treatment and took considerable effort to achieve. This is consistent with current evidence that suggests that interventions based on one aspect of clinical care are more likely to succeed than a global management strategy.²⁴ In our study, the provision of asthma management plans increased. This was due to prompts on hospital paperwork regarding discharge planning and ease of writing the management plan with a computerised plan generator. The improved provision of a management plan is a doctor centred outcome; unfortunately there was no evidence that this improved patient outcomes. Whether a more substantial education strategy based on the management plan would have improved outcomes is difficult to know, but evidence from a systematic review of asthma education interventions in children did not show a reduction in subsequent emergency department attendances, hospital admissions, or unscheduled doctor visits.²⁵

It is possible that our guidelines were followed by medical and nursing staff, but treatment recommendations were not followed by the parents and children. There are many factors that influence the extent to which parents and children might follow recommendations; including their own health beliefs, cultural issues, social factors, home environmental

factors, involvement with other medical practitioners, and alternative health practitioners.

The broad scope of this project, to globally improve asthma management, was ambitious. Implementation of our evidence based guidelines was associated with some improvements of in-patient care, but we were unable to influence the interval management of asthma. We have already shown that it is possible, with considerable effort, to change clinical practice in specific areas, but global change is more difficult. Future efforts to improve asthma management should target specific components of asthma care.

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Authors' affiliations

J Massie, B Cerritelli, E Gilbert, C F Robertson, Department of Respiratory Medicine, Murdoch Children's Research Institute, Royal Children's Hospital

D Efron, M South, Department of General Medicine, Royal Children's Hospital

C Powell, Departments of Emergency Medicine & General Medicine, Murdoch Children's Research Institute, University of Melbourne, Royal Children's Hospital

M M Haby, Centre for Community Child Health, Royal Children's Hospital

S Vidmar, J Carlin, Clinical Epidemiology and Biostatistics Unit, Murdoch Children's Research Institute, Royal Children's Hospital

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Improving Children and Adolescent Asthma Management (ICAAM) Study Group: Ms Belinda Cerritelli, Dr Daryl Efron, Dr Michelle Haby, Dr Claire Harris, Ms Emma Gilbert, Gill Kainey, Professor Andrew Kemp, Dr John Massie, Professor Frank Oberklaid, Dr Colin Powell, Associate Professor Colin Robertson, Associate Professor Susan Sawyer, Associate Professor Mike South, Dr Mimi Tang

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Table 5 Quality of life measures at three month follow up

Quality of life	Cohort 1 %	Cohort 2 %	Cohort 3 %
Child			
Limited social activity			
Every day	0.5	0.6	0.0
Most days	2.2	2.2	1.9
Some days	12.1	10.6	10.2
Few days	24.0	24.6	23.9
Not at all	61.2	62.0	64.0
Missed school			
No	46.3	39.1	54.6
Yes	53.7	60.9	45.4
Parent			
Asthma limited activities			
Every day	1.3	0.6	1.1
Most days	3.8	3.6	3.3
Some days	14.0	14.6	11.7
Few days	31.7	34.6	31.0
Not at all	49.2	46.6	52.9
Missed work			
No	73.4	75.0	80.0
Yes	26.6	25.0	20.0

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