Outcomes measurement for asthma following acute presentation to an emergency department

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Abstract

The Asthma Management Plan (AMP) was developed by the Thoracic Society of Australia and New Zealand in 1989 to provide a more uniform approach to asthma care, aimed at reducing mortality, morbidity and emergency presentations. The AMP is often supplemented with Asthma Clinical Pathways (CPs) within the emergency department and hospital setting.

This study was designed to evaluate the impact of these two instruments on asthma outcomes one month after presentation to the emergency department. The AMP and CP were both found to have had positive influences on asthma management. However, the study illustrates that there continue to be problems with asthma management, which would be improved by a more consistent use of these instruments.

Introduction

Since the early 1980s, asthma in Australia has increased in prevalence at about 0.5% per year (Bauman, 1998). Over this period, Bauman (1998) reports that asthma in children increased from a prevalence of 10% to 20% whilst in adults the increase has been from 7% to 12%. Mortality rates from asthma have dropped over 50% from 1.5 deaths per 100,000 in 1992 to less than 0.8 deaths per 100,000 in 1995. Bauman (1998) and Yoon et al (1993) attribute this decline to the combined effect of improved asthma management and better education of patients including the use of the Australian Asthma Management Plan (AMP).

In 1989, the AMP was developed in an attempt to create a unified approach to the management of asthma (Woolcock et al, 1989). However, a study in South Australia six years later, showed that less than half of people with asthma use an AMP (Beilby et al, 1997). Increased uptake would be expected to reduce the preventable morbidity and mortality, severity and number of emergency presentations from asthma that are currently occurring.

In addition to AMPs, clinical pathways for asthma have been developed by many hospitals. In the study we are to describe, an Asthma Clinical Pathway (CP) was developed for a specific large tertiary hospital, using the definitions of asthma severity (National Asthma Campaign, 1992, 1993) and with consideration of the medical evidence for best practice (Beveridge et al, 1996, Woolcock et al, 1989, 1994). The pathway was designed to replace existing paperwork associated with assessment and treatment in the emergency department and includes referral of those

discharged from the emergency department to an Asthma Clinic for further education, assessment and treatment.

The evaluation of clinical pathways has typically focused on reducing length of stay and costs rather than on quality of care or health outcomes. In fact, little is known about the latter for patients with asthma who present to an emergency department. In particular, those who are treated and sent home are thought to have poor compliance with follow up (Bauman et al, 1995). They are therefore a group where the implementation in the emergency department of guidelines for assessment, treatment and follow up may yield a significant improvement in outcome.

This study had two aims. The first was to define and demonstrate the measurement of asthma health outcomes and outcome related performance indicators in the community, one month after presentation to the hospital emergency department with asthma. In particular, the influence of the use of an AMP on these measures would be evaluated. The second was to assess the effect of an asthma clinical pathway on the process of assessment and treatment for patients with asthma and to measure its effect on asthma health outcomes.

Methodology

This was an interventional study with unblinded, unmatched internal controls. Patients who had presented at the emergency department with a diagnosis of asthma were identified from the hospital information system. The intervention group consisted of asthma subjects who presented after the implementation of the asthma clinical pathway whilst the control group subjects were those who had presented prior to implementation. The inclusion criteria limited participation to those aged over 17 years who were not admitted to intensive care. Ethical approval was gained from the hospital ethics committee.

Asthma related health outcomes were measured by a structured telephone interview one month after the presentation. A chart audit was performed assessing both health outcomes and performance indicators and in the case of the intervention group, whether or not the clinical pathway had been implemented. Prior to commencing the study, the telephone interview, chart audit and clinical pathway documents were piloted on twenty subjects with asthma and the results used to refine the interview and audit processes.

One primary outcome measure was the use of agonists (reliever medication) which are a class of medications used to relieve the symptoms of asthma and are generally used as a supplement to control and preventer medication for everyday use. An increased use of agonist medication often indicates poorly controlled asthma. Data collected during interview included the type of agonist medication used, frequency of use in the previous 24 hours, and asthma symptoms as measured by 1) nocturnal waking, 2) the need for agonist immediately on waking and 3) impairment of normal physical activity. The patient was also asked if they possessed a peak flow meter and an AMP, and whether they had been reviewed by a doctor within a month of their presentation to the emergency department with asthma. (A peak flow meter is a device that is used to monitor the airflow out of the lungs. Negative changes in airflow may indicate that the asthma is worsening and the patient needs to see a doctor).

Performance indicators measured by chart audit included whether asthma severity was documented, prescription of steroid ('preventer') medications and the documentation of follow-up arrangements. There was also an asthma interval assessment, eliciting previous asthma symptoms, asthma self-management and episodes of care; factors that are associated with a high risk of poor outcome.

Analysis of the data mostly involved the comparison of proportions using the chi-square test of association. The non-parametric Kruscal-Wallis test was used to compare the outcome of Asthma Symptom Scores, as the distribution of these scores was bimodal.

Results

Recruitment of the control group took place between February and June 1997 and consisted of 104 consecutive patients. The intervention group consisted of 97 consecutive patients presenting during the months of August to December 1997. Only two patients refused to participate in the telephone survey and 22 patients could not be contacted by telephone. Hence, the recruitment rate was 89%. The groups were similar in age ($\chi^2 = 0.72$, p

= 0.98) and rate of hospital admission (χ^2 = 0.41, p = 0.99). Not all subjects had an asthma severity score; however, for those that did there was no significant difference (χ^2 = 0.85, p = 0.55) between the scores of the control (n = 56) and intervention group (n = 80).

The interviews revealed that almost half of the study population had experienced some degree of disturbed sleep, morning cough or impaired daily activities, a month after their presentation to the emergency department. There were no significant differences in these scores between those admitted to hospital and those discharged from the emergency department, nor between the control and intervention groups. There was however, a significant reduction in (agonist 'reliever' usage per 24 hours for those patients with a clinical pathway implemented (Table 1).

At one month after presentation, 65% of all patients possessed a peak flow meter; however, the difference between the control and intervention groups was not quite significant. Of those who had consulted a doctor in the interim, 56% of the control group and 79% of the intervention group possessed a peak flow meter (χ^2 = 2.7, p =0.01). Patients were also more likely to possess a peak flow meter than an AMP (χ^2 = 2.1, p = 0.00). Of those discharged home from the emergency department 56% possessed a peak flow meter compared with 80% of those admitted (χ^2 = 13.1, p = 0.00).

Overall 31% of patients had a written AMP; however, there was no significant difference between the control and intervention groups. Of those who consulted a doctor following their presentation to the emergency department, 25% of those discharged home had an AMP compared with 44% of those admitted (χ^2 = 1.33, p = 0.02).

The chart audit revealed that a severity assessment was recorded in the records of 54% of the control group and 82% of the intervention group (χ^2 = 22.1, p = 0.00), although there was no difference in the severity scores. Interval asthma status was recorded in 58% of cases and there was no association with the asthma clinical pathway or with asthma severity. Steroids are often used to treat acute severe asthma attacks and can be given orally as tablets in less severe cases and intravenously (IVI) in more severe cases. There was no significant difference between the control and intervention groups in the proportion given oral or IVI steroids in the emergency department (χ^2 = 1.3, p = 0.52), nor was there a difference at one month in the type of medication being utilised (Table 2).

The amount of medical follow-up was also evaluated at chart audit. During the month following their presentation, 34% of patients had not been to a doctor for review, 29% saw a doctor because their asthma was concerning them and the remaining 37% had an appointment for regular review of their asthma. There was no significant difference between the control and intervention groups in any of these measures. When discharged home from the emergency department, 10% of patients were advised to return if they had any problems, 46% were advised to attend their General Practitioner, 20% were referred to the hospital outpatient department and no advice was recorded in 24% of medical records. There was no significant difference in follow up arrangements for the control and intervention groups. In regards to actual medical follow up, there was a significant difference as to where this actually occurred following discharge either from the emergency department or from the ward (Table 3).

The final part of the evaluation focused on the hospital's clinical pathway, which was found to have been used in only 41% of intervention cases (Table 4). As might be expected, a higher degree of asthma severity was associated with pathway use (χ^2 = 8.2, p = 0.03). Pathway use was also associated with documentation of asthma severity. Where a pathway document was used, 85% of patients had a peak flow meter compared with 60% where it was not used and 56% in controls (χ^2 = 9.2, p = 0.01). This may purely reflect the association between greater asthma severity and pathway document use.

There was no significant difference in the proportion having laboratory investigations between the control and intervention groups, whether or not a clinical pathway was used. However, there was a trend towards more investigations in the pathway document group, which would be expected from the association with increased asthma severity (Table 5).

Table 6 illustrates the percentage of patients receiving four of the more common laboratory investigations for those discharged home and for those admitted. There was a substantial proportion of patients discharged home from the emergency department following significant investigations, including arterial blood gas analysis. There

was though no significant difference between the control and intervention groups with regards to performance of respiratory function tests and pulse oximetry. (Pulse oximetry is used to measure the amount of oxygen in the blood using a small peg like device that is clipped to the finger to continually measure the oxygen levels during asthma attacks; low or falling oxygen levels are a dangerous sign). Pulse oximetry was recorded at least once for 86% of patients. Respiratory function was recorded at least once in 89% of patients. The forced expiratory volume (FEV1) is the amount of air that the patient can force out of their lungs with one breath over one second. A drop in the FEV1 indicates worsening asthma. Overall, 66% of patients had their FEV1 measured on presentation and 33% on discharge. The forced vital capacity (FVC) is similar to the FEV1 but includes the rapidity that the air is expelled at. The FVC was measured in 56% of patients on presentation and in 29% on discharge. Lastly, the peak expiratory flow rate (PEFR) was measured in 55% of patients on presentation and in 33% on discharge. The peak expiratory flow rate is the maximum flow rate of air out of the lungs. A drop in the rate also indicates worsening asthma.

Discussion

This has been a valuable survey of the process of asthma care and of the health status of patients following discharge from a large tertiary hospital. It demonstrates the measurement of health outcomes and performance indicators for the assessment and treatment of acute asthma, which derive from the AMP. The health outcomes, such as the asthma symptom scores and (agonist usage, relate to severity assessment and control of asthma. The performance indicators, such as possession of a peak flow meter and organisation of a follow up appointment, measure the effectiveness of the process of asthma management in the hospital.

Overall, 34% of patients did not see a doctor following their discharge, confirming the finding by Bauman et al (1995) that many patients do not attend for regular review. Follow up arrangements were not documented in 24% of those discharged from the emergency department, a proportion similar to that found by Gibson et al (1993). Regular medical review, particularly after an acute exacerbation, is necessary for the implementation of the Australian AMP, because the knowledge and skills necessary for self-monitoring and self-management need to be taught and checked.

The emergency department is not a suitable environment for this learning and, as Gibson and Wilson (1996) concluded, a recent episode of asthma presents a window of opportunity for more effective education and self-management programs. Greater emphasis on directing patients to either their General Practitioner or to the Asthma Clinic should therefore yield a significant improvement in outcome.

Beilby et al (1997) consider that General Practitioners have a greater opportunity to implement the Australian AMP over a number of consultations and yet Pearson et al (1995) found that respiratory specialist care provides better care than other physicians.

Gibson et al (1993) found that 69% of patients in Australia possessed a peak flow meter and 24% had a written AMP. The number with an AMP has increased slowly and by 1998/99 rates of 33 and 42% were being reported in South Australia (Adams et al, 1998 and Ruffin et al, 1999). Abdulwadud et al (1999) reported 50% of hospitalised patients and 25% of community patients with an AMP in Victoria. This study provided somewhat larger figures of 65% possessing a peak flow meter and 31% having a written AMP. The higher proportion of patients possessing a peak flow meter compared with those having a written AMP probably results from free peak flow meters being given out by the hospital specialists. There may also be a perception that the technology of peak flow measurement somehow enhances a patient's ability to manage their asthma better than spending the time to teach patients the importance of their symptoms (Turner et al, 1998) and to develop a written AMP. The AMP is based on measures of severity using either the peak flow rate or a symptom score. The low rate of peak flow meter usage during an episode of asthma, by those who possess them, as found by Gibson et al (1993) and Bauman et al (1995), suggests that many patients do not understand the importance of measuring asthma severity. Early recognition of severity and prompt effective treatment are important goals of the Australian AMP.

As described by Gibson et al (1993), patients discharged from the emergency department are less likely to possess a peak flow meter or a written action plan and are less likely to be seen by a respiratory specialist compared to those who are admitted. Whilst it can be argued that their asthma was less severe, one month

following their presentation to the emergency department, almost half were still experiencing significant asthma symptoms and their symptom scores were similar to those who had been admitted to hospital. Furthermore, 14% of these patients re-presented to the emergency department with asthma within one month. This subgroup merits additional investigation as the re-presentation may represent a failure in adequate assessment, treatment or follow up. Overall, this study supports the conclusion of Gibson et al (1993) that patients discharged home from the emergency department tend to have inadequate asthma treatment and poor management skills. The Australian AMP recommendations of obtaining and maintaining best lung function are not being implemented very well in this population, with the low rate of medical review being a major causative factor for this under-treatment and poor symptom control.

The major significant differences found between the control and intervention groups were an increase in the intervention group of the proportion whose asthma severity was documented, an increase in the proportion possessing a peak flow meter and a reduction in the use of (agonist 'reliever' medication, which was not associated with a change in asthma symptom scores. As the use of (agonist 'reliever' medication is associated with sudden exacerbations of asthma and it can be inappropriately used instead of 'preventer' medications, the reduction in usage may represent an improvement in care and a reduction in risk of emergency presentation. The usefulness of this score has been reviewed by Smith et al (1996) and it is yet to be validated as an indirect measure of asthma severity or asthma health outcome. As discussed previously, the study design, staffing improvements and the different season, would tend to be confounding factors that may have resulted in a difference in process or outcome that was not related to the Asthma Clinical Pathway.

Following implementation of the pathway, the level of documentation of asthma severity was similar to that found by McLeod (1996) in New Zealand using an asthma assessment and treatment guideline. Asthma interval assessment was found to be documented in 58% of charts compared to 95% found by McLeod (1996). This large difference may reflect, at least in part, a difference in measurement technique.

The proportion of patients with each of the four investigations being performed showed that those admitted had a much higher incidence, as would be expected. Arterial blood gas measurement is an invasive procedure to be performed on 12% of patients who were ultimately discharged from the emergency department. The development of guidelines for appropriate use may lead to a safe reduction in its incidence. Similarly Chest x-rays and general blood tests were performed on 26% and 30% respectively and may also be amenable to a safe reduction in their use, for patients who are discharged from the emergency department.

Three different respiratory function tests were documented as being performed on presentation in respectively 66%, 56% and 55% of patients. The incidence of performing the test on discharge from the emergency department was about half that on presentation. At least one of these tests was documented as being performed on 89% of patients. Clearly some patients had more than one test performed while no tests were documented as being performed on others.

Standardisation of respiratory function tests and repeating the same test on discharge would improve the information available to the reviewing medical practitioner and may also reduce the amount of nursing time involved in performing the such tests.

The poor participation rate in actually using the pathway document means that the implementation of the document needs to be reviewed. It is notable that pathway use was associated with higher degree of asthma severity and with asthma severity documentation in 38 of 40 cases. The association of asthma severity documentation and possession of a peak flow meter with pathway document use reflects the association of asthma severity with document use. Staff may not have used the document in mild cases due to uncertainty of the presenting diagnosis or because of the complexity of the document. Although the pathway document was only used in 41% of suitable cases, it may still have exerted a degree of influence on the management of the other patients in the intervention group, due to a general educational effect. Nonetheless, the lack of effect found in this study may well be related to poor participation.

Conclusion

This study has demonstrated an increase in the proportion of medical records that noted asthma severity, an increase in possession of peak flow meters and a reduction in (agonist use following the introduction of an Asthma Clinical Pathway to the emergency department of a tertiary level hospital. Severity assessment is an important aspect of asthma treatment and its formal documentation may be considered an improvement in the process of care delivery. Possession of a peak flow meter is one of several key indicators in the Australian Asthma Management Plan. The significant reduction in (agonist use may indicate a real improvement in asthma care, either because it represents reduced asthma symptoms, better use of 'preventer' medications or both.

This study supports the findings in the literature that patients discharged from the emergency department tend to have inadequate treatment. It has demonstrated that there is substantial room for improving the asthma care process as measured by indicators such as the proportion of patients having a written action plan and seeing a doctor for review soon after presentation to the emergency department. A reduction in the asthma symptom scores would be evidence of the desired outcome, namely an improvement in health status due to an improved care process.

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Table 1. Frequency of (agonist use per 24 hours at telephone interview by control and intervention groups

Puffs of βagonist per 24 hours	Control Group % (n = 104)	Intervention Group % (n = 97)
0	25.5	32
1-4	51	61
5+	23.5	7
	$\chi 2 = 10.6$, (df = 2), $p < 0.001$	

Table 2. Asthma Medications used by the control and intervention groups one month after presentation to the emergency department

Drug Type	Control group	Intervention group
Steroid - 'preventer	92	80
Chromoglycolate - 'preventer'	6	5
Mixed - 'preventer'	41	24
β agonist 'reliever'	112	105
	$\chi 2 = 2.6$, (df = 3), $p = 0.44$	

Note: As patients could use more than one type of medication and more than one of any type, the figures may be greater than 100%.

Table 3. Type of medical follow-up following discharge from hospital

Type of medical follow-up	Discharged home from ED (%)	Admitted to Ward (%)
Did not see a doctor	38	30
Emergency Department	14	3
General Practitioner	32	27
Specialist	17	41
	$\chi 2 = 16.3$, (df = 3), $p < 0.001$	

Table 4. Asthma Severity and Clinical Pathway use in the control and intervention groups

Severity	Control	Intervention group	
		No pathway documen	Pathway document
Not recorded	48	14	2
Mild	36	29	15
Moderate	13	9	15
Severe	7	4	8
Totals	104	56	40
	$\chi 2 = 8.2$, (df = 8), p = 0.03		

Table 5. Laboratory Investigations and Clinical Pathway use in the control and intervention groups

Investigation	Control (%)	Intervention group (%)	
		No pathway document	Pathway document
Chest x-ray	40	47	58
Full blood count	38	40	50
Urea & electrolytes	32	39	48
Arterial blood gases	26	35	33

Table 6. Investigations performed in the emergency department by place of discharge

Investigation	Discharged home (%)	Admitted to hospital (%)
Chest x-ray	30	76
Full blood count	26	70
Urea and electrolytes	23	63
Arterial blood analysis	12	63
	$\chi 2 = 3.1$, (df = 3), p = non significant	