ORIGINAL ARTICLES

Structured discharge procedure for children admitted to hospital with acute asthma: a randomised controlled trial of nursing practice

L J Wesseldine, P McCarthy, M Silverman

Abstract

***Background*—Discharge planning is becoming an important part of the management of childhood asthma in hospital. Readmission to hospital, although often inevitable, might represent a failure of the opportunity for intervention presented by a brief period of supervised care in hospital.**

***Aim*—To examine the impact of a structured, nurse-led discharge package for children admitted to hospital with acute asthma on readmission to hospital, reattendance at the accident and emergency (A&E) department, and general practitioner consultations for asthma.**

***Methods*—A structured nurse-led discharge package, consisting of a 20 minute patient education programme and self management plan for children with asthma was developed on the wards of a busy children's hospital. A randomised controlled trial was conducted involving 160 children aged 2–16 years admitted for asthma over a 12 month period. Readmission and A&E reattendance's over the six months after discharge from hospital were obtained from the hospital computerised information system and general practitioner consultations from practice records.**

***Results*—Children in the intervention group were significantly less likely to be readmitted to hospital in the next six months than those in the control group (12 of 80 *v* 30 of 80 patients), and significantly less likely to attend the A&E department (6 of 80 *v* 31 of 80). Significantly fewer children in the intervention group had visits to their general practitioner for problematic asthma (31 of 78 *v* 72 of 77 for whom data were available).**

***Conclusion*—By delivering the simplest form of education and support during a child's stay in hospital, readmissions over a six month period were reduced. The programme was designed to be suitable for administration by nursing staff on the children's wards after a brief period of training.**

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Keywords: nurse-led discharge planning; asthma; randomised controlled trial; readmission

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Asthma and related wheezing disorders are the most common single group of diagnoses among children admitted to hospital.[1] Admissions to hospital for childhood asthma have increased dramatically over the past two decades.[2–4] Whether this increase is because of greater morbidity or changes in the recognition and management of childhood asthma, or even the increased use of "asthma" as a diagnostic label, is unclear. It has also been suggested that the overall increase in admissions could be due partly to an increase in readmissions.[3 4] A recent study suggested that one contributory factor could have been the introduction of direct access or "open door" policies for patients with asthma, which bypass general practitioners.[5] Whatever their immediate cause, readmissions may be a failure of management to tackle acute asthma early or vigorously enough or to address avoidable factors.

Mitchell *et al* found that medical treatment and management themselves did not seem to influence readmissions and concluded that strategies to reduce the high readmission rate for asthma in childhood needed to be developed.[6] They identified several risk factors for readmission of children with asthma, including demographic characteristics (being female and being less than 5 years old), severity of the asthma (the need for intravenous treatment), and the number of previous admissions (reflecting either the severity of asthma or illness related behaviour).[6] A more recent study in Canada also concluded that further studies were required to identify factors associated with increased readmissions among children, particularly girls.[7] Between the ages of 10 and 14 years, girls had a greater rate of readmission than boys. One explanation for this finding was that although asthma may be more prevalent in boys than in girls, as judged by overall hospital admission rates, its severity, rate of onset of acute attacks, or illness related behaviour may be different for girls, leading to more readmissions. Younger children had a greater rate of readmission than older children.[6 7] This could in part be explained by the episodic nature of

Table 1 Characteristics of the study groups and their inpatient asthma care

	Intervention group (n = 80)	*Control group (n = 80)*
Sex (male:female)	50:30	48:32
Age		
2–5 years	51 (64)	49 (61)
6–10 years	14 (17)	18 (22)
11–16 years	15 (19)	13 (17)
Median age in years (range)	5.9 (2–16)	5.6 (2–15)
Current admission		
Median length of stay in days (range)	2 (1–5)	2 (1–7)
Nebulised bronchodilators	80 (100)	78 (98)
Oral steroids	77 (97)	79 (99)
Intravenous aminophylline	5 (6)	6 (8)
Peak flow recording aged 6–16 years	22 (75)	25 (80)
Previous admission at any time	34 (43)	40 (50)
Previous admission in last six months	16 (20)	19 (24)
Previous attendance at A&E department	18 (23)	15 (19)
Consultations with GP for respiratory illness in previous six months (range)	3 (0–7)	3 (0–6)

Values are n (%) unless otherwise stated.

preschool asthma and its poor response to preventive treatment.[8]

Among admissions for acute asthma in the 2–16 age group in Leicester (about 600 each year), 24% were readmissions within the calendar year. Readmission rates of 25% in Glasgow, UK,[9] 28% in Saskatchewan, Canada,[7] 33% in Auckland, New Zealand,[6] and 45% in Brighton, UK[10] suggest that these figures are not exceptional. Readmission to hospital, although often inevitable, might be a failure of the opportunity for intervention presented by a brief period of supervised care in hospital.

There has been increasing interest in improving self management through patient education. A recent meta-analysis of randomised trials of programmes to teach self management to children with asthma showed that these programmes had surprisingly little effect on morbidity.[11] This may have been because the teaching programmes had not been designed for specific target groups—well defined by age, setting, disease severity, and therapeutic protocol. In contrast, a recent programme for adults with asthma in Aberdeen showed a significant effect when self management plans were introduced.[12] Days in hospital and visits to outpatients were reduced, as were consultations in general practice and severity of symptoms. In another Scottish study, a one year clinical trial of asthma care in children identified clear evidence that structured nurse-led discharge planning and follow up can substantially reduce morbidity, with a fall in the readmission rate from 25% in the control group to 8% in the intervention group over the subsequent 12 months.[9] Such intensive education requires considerable time and commitment by staff.

We aimed to examine, by means of a randomised controlled trial, the effectiveness of a structured nurse-led discharge package for children with asthma. The intention was that, if successful, it could be given in 20 minutes by nursing staff on the children's wards after a brief period of training. The discharge package would be implemented for children between the ages of 2 and 16 years who had been admitted to hospital with a diagnosis of acute severe asthma. The primary objectives were to reduce readmission or reattendance rates.

Patients and methods

The study population comprised children between 2 and 16 years old who were admitted to the children's hospital in Leicester with a diagnosis of acute asthma during 1996. Many eligible children were missed because of time constraints or because the investigator (LJW) was unavailable for recruitment on the day of discharge. All children and their parents who were approached for the study agreed to participate and provided written consent. Approval was given by the Leicestershire health ethics committee.

STUDY DESIGN

Randomisation took place at the time of discharge using computer generated numerical codes in blocks of 10, held in sealed envelopes, which were opened after consent had been obtained. Basic information was recorded and consent for the data collection aspects of the study was obtained before children were randomly assigned either to a control group, when they received standard care from ward staff, or to an intervention group, when they received a structured discharge package from the main investigator—a trained children's asthma nurse (LJW). Standard discharge care was variable and dependent on factors such as availability of parents, enthusiasm, and experience of medical and nursing staff and, of course, time constraints. Some children received written information, some verbal information, some received an inhaler demonstration, but few received a written home management plan.

The structured discharge package consisted of an interview during which information was provided on the nature of asthma, the recognition of risk factors and how to avoid them, and on drugs and devices. The educational component emphasised guided self management and an individual written home management plan was devised for each child, which allowed doses of preventers and relievers to be adjusted according to symptoms and peak flow (for children over 7–8 years). Short courses of oral steroids were not always included in the management plan for children randomised to the intervention group, but were provided if previously used and if acceptable to parents. A short booklet for parents and children entitled *At home with asthma* was provided to reinforce verbal information (devised by LTW). It also formed the basis for the structured discharge interview. The booklet also contained relevant local and national contact numbers for additional advice such as the National Asthma Campaign Helpline and the local asthma support group. To provide a standard intervention, the whole educational component was given by a single specialist nurse (LJW). It was anticipated that the interview with the children and their families would take no longer than 20 minutes and would, if effective, be realistic for staff to implement on the children's wards in the future.

Table 2 Morbidity in intervention and control groups over six weeks after discharge

	Intervention group (n = 76) (%)	*Control group (n = 74) (%)*	χ^2	*p Value*
Hospital readmission	3 (4)	5 (7)	0.59	NS
A&E attendance	2 (3)	8 (11)	4.03	< 0.05
Consultations with GP for problematic asthma	12 (16)	22 (30)	4.16	< 0.05
Outpatient visits	10 (13)	11 (15)	0.09	NS
Reported cold/flu-like symptoms	41 (54)	48 (64)	1.85	NS

Data unavailable for 10 children.

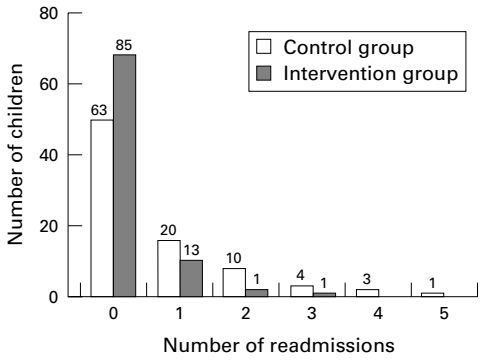

Figure 1 Asthma readmissions within six months of discharge for intervention and control groups (percentages are shown at the top of each column; because of rounding percentages may not sum to 100).

QUESTIONNAIRES

Baseline data were collected from both control and intervention groups through a questionnaire completed by the parent or child, or both, on the day of discharge from hospital. As well as obvious demographic details, we recorded age at diagnosis, medication, admissions to hospital, attendance at accident and emergency (A&E) departments, and consultations with general practitioners. We also recorded details of the pattern and severity of asthma symptoms, atopy, and allergy, and any known precipitating factors.

Each family was sent a postal questionnaire six weeks after the date of discharge. The self administered questionnaire was designed to record nocturnal symptoms, activity restrictions, frequency of specific infections, and attendance at general practice.

OUTCOME MEASURES

The primary outcome measure was readmission to hospital in the six months after discharge, obtained from the hospital's computerised patient information system. An admission was defined as an overnight stay with acute asthma on a children's ward. Differences in outcome between boys and girls and age groups (under *v* over 5 years) were assessed.

Secondary outcome measures included reattendance without admission, either at the A&E department or children's admission unit. Further subsidiary outcome measures were devised for the six week questionnaire. General practices were telephoned to determine the number of consultations (excluding repeat prescriptions and planned check ups) for any acute lower respiratory illness over the subsequent six months. For schoolchildren, individual schools were contacted to record the number of days lost for any medical illness over the same six month period.

STATISTICAL ANALYSIS

To detect a 50% reduction in readmission and reattendance rates with 80% power at a 5% level of significance, 160 children were recruited. The SPSS statistical package was used to analyse the data. The groups were compared by χ^2 or Mann–Whitney U tests.

Results

All 160 children were recruited in the 12 month period, January to December 1996. The groups were comparable on entry to the trial in age, length of stay in hospital, inpatient treatment, previous attendance at A&E, and emergency consultations with a general practitioner (table 1).

The six week morbidity questionnaires were returned by 132 families (62 intervention (77%) and 70 control (87%)). A further 18 questionnaires were done by telephone, for reasons such as lost paperwork or change of address. A total of 150 (93%) questionnaires were analysed. Significant reductions were recorded in the intervention group compared with the control group in respect to daytime and night time symptom scores, hospital admissions, primary care consultations, and reattendance at the A&E department (table 2).

Over the six month period after discharge from hospital the proportion of children readmitted was significantly lower in the intervention group (15%) than in the control group (37%) ($\chi^2 = 10.5$, $p = 0.001$) (table 3). Because of multiple readmissions in many of the control children, the total number of readmissions over six months in the control group (n = 69) far exceeded the number for the intervention group (n = 18) (fig 1).

The intervention group had a significantly lower rate of reattendance at the A&E department than the control group (8% *v* 38%; $\chi^2 = 22$, $p < 0.001$). Consultations in general practice for problematic asthma were substantially less in the intervention group (31

Table 3 Morbidity in intervention and control groups over six months after discharge

	Intervention group (n = 80)		*Control group (n = 80)*			
	Children for whom data are available (n)	*Outcome*	*Children for whom data are available (n)*	*Outcome*	χ^2	*p Value*
Hospital readmission (%)	80	12 (15)	80	30 (37)	10.5	0.001
A&E attendance (%)	80	6 (8)	80	31 (38)	22	0.001
Consultations with GP for problematic asthma (%)	78	31 (39)	77	72 (90)	50	0.001
Median school loss in days (range)	38	2 (0–10)	34	2 (0–10)	–	0.07

children, 39%) than in the control group (72 children, 90%) ($\chi^2 = 50$, $p < 0.001$) (table 3). School absence for any medical illness during the six months after discharge, showed little difference between the two groups (median two days, NS) (table 3).

The sex ratio of readmissions (boy:girl) of 1.8 at six months was no different from the overall ratio within the study of 1.6. No difference existed in the readmission ratio between intervention and control groups.

The ratio of readmission of children under 5 to older children was 2.5, slightly higher than the overall ratio in the study of 1.7 ($\chi^2 = 1.9$, $p < 0.25$). No significant difference existed in the effectiveness of the intervention for children younger than 5 compared with older children ($\chi^2 = 1.16$, $p < 0.5$).

The mean (SD) time taken to give the structured discharge package was 23 (2.9) minutes.

Discussion

The rate of readmission to hospital for asthma is one indicator of the overall efficacy of asthma management in a community.[13] The factors which contribute to readmission are numerous and differ between patients. We did not set out to identify these factors, but to test a pragmatic approach to reduce readmissions, based on good clinical practice.

Several studies have investigated the effect of nurse-led education on admission to hospital. A study in the south of England compared the effect of a nurse-led outpatient clinic for children aged 3–14 years in hospital with a control group.[14] Although this study failed to show a reduction in readmissions, it did identify a reduction in home visits by general practitioners and in time lost from school. In another study children and adults aged 3–83 years attending a nurse-run asthma clinic with its programme of structured care, also identified a reduction in attacks of wheeze, nocturnal symptoms, and general practitioner home visits.[15] In an American adult study, two one hour education sessions with an asthma nurse followed by an open door programme showed a clear reduction in subsequent admissions for asthma.[16] Several adult studies have evaluated the effectiveness of various teaching methods. Osman *et al* evaluated a personalised education programme for patients with asthma and identified a clear reduction in hospital admissions and improved morbidity among hospital outpatients.[12] D'Souza *et al*'s trial of an asthma "credit card" management plan,[17] Jenkinson *et al*'s comparison of an asthma self management booklet and audio cassette,[18] and Mulloy *et al*'s video education[19] all led to favourable outcomes. However, a recent meta-analysis of randomised controlled trials of such programmes showed little effect on morbidity.[11]

Our study has reinforced the belief that a brief, individual, and simple educational programme that provides a specific, written management plan, together with instructions on the use of inhalers and peak flow devices and on crisis management, can reduce the likelihood of readmission to hospital for at least six months.

The design of the study could be criticised because the intervention and data collection were all done by a single investigator—a paediatric respiratory nurse specialist. The main reason for this was to ensure consistency of intervention. Translated into the normal working environment of a children's ward, in which the discharge package would be given by a variety of more or less motivated individuals with variable time constraints, the outcome might not be so positive.

We attempted to avoid bias by our choice of outcome measures. The most critical data were collected from hospital or general practitioner records. Although their reliability could be disputed, the trial was of sufficient size and the results sufficiently decisive to overcome any potential inconsistency. It is possible that general practitioners or hospital staff could have altered their approach to those who had been given the discharge package. However, no record was made in hospital casenotes and no hint was given to general practitioners of the group assignment.

Because of the trial design, we were unable to determine the critical changes in behaviour by the parent or child which led to improved outcome. For instance, did increased confidence lead to more prompt introduction of rescue treatment, such as β_2 agonists or oral corticosteroid courses? It would be important to monitor this aspect of care in future studies because the benefit of reduced admissions must be set against the potential harm of excessive corticosteroid use.

The revised British guidelines recommend contact between a recently discharged patient and a doctor.[20] We did not include this requirement for logistic reasons. Madge *et al* implemented an asthma home management training programme which incorporated written and verbal information and was reinforced by a nurse-led outpatient follow up appointment and telephone advice, which perhaps contributed to their very successful outcome.[9] This poses the question: which elements of such a package are critical? To answer this question would need a multifactorial trial design of great complexity and huge size. The potential health gains might not justify such a study.

Our procedure and that used in Glasgow,[9] provide benchmarks against which further refinements can made. This form of discharge planning appears to be effective. The technique should be generalised to study other common chronic or recurrent disorders, such as eczema and febrile convulsions.

If indeed discharge planning establishes itself as practicable, then the modest cost of a discharge facilitator could be offset by the cost savings produced by a reduced readmission rate. The possibility of purchasing a discharge nurse facilitator may raise awareness, leading to improved management for children with asthma and other conditions. Being more adventurous, we suggest the transfer of our discharge package into the primary sector. In an attempt to prevent first admissions for

asthma, we should assess the impact of the package when given by community or primary care nurses for selected patients at high risk of admission to hospital.

CONCLUSIONS

The methods used in many previously published studies, although effective, are impracticable in clinical practice, requiring prolonged periods of interaction between health professionals and families that would be costly if applied to all children admitted to hospital with asthma. The simple message from all of the studies is that information should be made available in various different formats to meet individual needs, yet at the same time the advice provided must be consistent. The skills to help families gain confidence in coping with a child who has asthma should be made more readily available within hospital settings, as well as in general practice.

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1 Hill A. Trends in paediatric medical admissions. *BMJ* 1989;**298**:1479–83.
2 Mitchell EA. International trends in hospital admission rates for asthma. *Arch Dis Child* 1985;**60**:376–8.
3 Anderson HR. Increase in hospitalisation for childhood asthma. *Arch Dis Child* 1978;**53**:295–300.
4 Anderson HR. Increase in hospital admissions for childhood asthma, trends in referral, severity, and re-admissions from 1970 to 1985 in a health region of the United Kingdom. *Thorax* 1989;**44**:614–19.
5 Crompton GK, Grant IWB, Blomfield P. Edinburgh emergency admissions service: report on 10 years experience. *BMJ* 1979;ii:1199–201.
6 Mitchell EA, Bland JM, Thompson JMD. Risk factors for re-admission to hospital for asthma in childhood. *Thorax* 1994;**49**:33–6.
7 Senthilselvan A. Effect of re-admissions on increasing hospital admissions for asthma in children. *Thorax* 1995;**50**:934–6.
8 Wilson N, Sloper K, Silverman M. Effect of continuous treatment with topical corticosteroids on episodic viral wheeze in pre-school children. *Arch Dis Child* 1995;**72**: 317–20.
9 Madge P, McColl J, Paton J. The impact of a nurse-led home management training programme in children admitted to hospital with acute asthma: a randomised controlled study. *Thorax* 1997;**52**:223–8.
10 Storr J, Barrell E, Lenney W. Rising asthma admissions and self-referral. *Arch Dis Child* 1988;**63**:774–9.
11 Bernard-Bonnin AC, Stachenko S, Bonin D, Charette C, Rousseau E. Self-management teaching programmes and morbidity of paediatric asthma: a meta-analysis. *J Allergy Clin Immunol* 1995;**95**:34–41.
12 Osman LM, Abdalla MI, Beattie JAG, *et al*. Reducing hospital admission through a computer-supported education for asthma patients. *BMJ* 1994;**308**:568–71.
13 Rushworth RL, Rob MI. Re-admission to hospital: the contribution of morbidity data to the evaluation of asthma management. *Aust J Public Health* 1995;**19**:363–7.
14 Charlton I, Antoniou A, Atkinson J, *et al*. Asthma at the interface: bridging the gap between general practice and a district general hospital. *Arch Dis Child* 1994;**70**:313–18.
15 Charlton I, Charlton G, Broomfield J, Campbell M. An evaluation of a nurse-run asthma clinic in general practice using an attitudes and morbidity questionnaire. *Fam Pract* 1992;**9**:154–60.
16 Mayo PH, Richman J, Harris HW. Results of a programme to reduce admissions for adult asthma. *Ann Intern Med* 1990;**112**:864–71.
17 D'Souza W, Crane J, Burgess C, *et al*. Community-based asthma care: trial of a "credit card" asthma self-management plan. *Eur Respir J* 1994;7:1260–5.
18 Jenkinson D, Davison J, Jones S, Hantin P. Comparison of effects of a self-management booklet and audio-cassette for patients. *BMJ* 1988;**297**:267–70.
19 Mulloy EMT, Abazzaz MK, Warley ARH, Harvey JE. Video education for patients who use inhalers. *Thorax* 1987;**42**: 719–20.
20 British Asthma Guidelines Co-ordinating Committee. British guidelines on asthma management. *Thorax* 1997; **52**(suppl):S1–21.