

## ORIGINAL ARTICLE

## A randomised trial of self-management planning for adult patients admitted to hospital with acute asthma

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Thorax 2002;57:869-874

**Background:** There is still debate over the benefit of self-management programmes for adults with asthma. A brief self-management programme given during a hospital admission for acute asthma was tested to determine whether it would reduce readmission.

**Method:** A randomised controlled trial was performed in 280 adult patients with acute asthma admitted over 29 months. Patients on the self-management programme (SMP) received 40–60 minutes of education supporting a written self-management plan. Control patients received standard care (SC).

**Results:** One month after discharge SMP patients were more likely than SC patients to report no daytime wheeze (OR 2.6, 95% CI 1.5 to 5.3), no night disturbance (OR 2.0, 95% CI 1.2 to 3.5), and no activity limitation (OR 1.5, 95% CI 0.9 to 2.7). Over 12 months 17% of SMP patients were re-admitted compared with 27% of SC patients (OR 0.5, 95% CI 0.3 to 1.0). Among first admission patients, OR readmission (SMP v SC) was 0.2 (95% CI 0.1 to 0.7),  $p < 0.01$ . For patients with a previous admission, OR readmission was 0.8 (95% CI 0.4 to 1.6),  $p = 0.6$ . SMP patients were more likely than SC patients to be prescribed inhaled steroids at discharge (99% v 92%,  $p = 0.03$ ), oral steroids (98% v 90%,  $p = 0.06$ ), and to have hospital follow up (98% v 84%,  $p < 0.01$ ) but adjustment for these differences did not diminish the effect of the self-management programme.

**Conclusions:** A brief self-management programme during hospital admission reduced post discharge morbidity and readmission for adult asthma patients. The benefit of the programme may have been greater for patients admitted for the first time. The programme also had a small but significant effect on medical management at discharge.

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Revised version received 19 April 2002  
Accepted for publication 19 April 2002

After an acute asthma hospital admission there is a high rate of readmission, typically about one in five patients within 12 months.<sup>1–3</sup> Outpatient educational programmes supporting self-management plans for adults with asthma often,<sup>4–6</sup> although not always,<sup>7</sup> reduce acute events and improve quality of life. However, only a minority of adult patients are willing to take part in outpatient self-management programmes.<sup>8,9</sup>

A hospital admission is an opportunity to give patients education in self-management, with clear explanation of their illness, reasons for treatment, and discussion of how they can best manage their illness. A programme given during a hospital admission is likely to reach a wider range of patients. The British Thoracic Society guidelines for hospital management of acute asthma recommend that all patients should be discharged with a self-management plan,<sup>10</sup> but a recent audit in 67 hospitals showed that only 56% of patients had received management plans before discharge.<sup>11</sup> Self-management planning during a hospital admission has been effective in reducing child readmission,<sup>3</sup> but no randomised controlled trial of self-management planning before discharge has been reported for adult patients admitted with acute asthma.

Self-management planning needs educational support. It has been shown in one trial that a management plan for adult outpatients, which was not supported by education and opportunity for discussion by the patient, did not influence patient outcomes.<sup>12</sup> Cote<sup>7</sup> and Ayres *et al*<sup>13</sup> found as much benefit from optimising treatment as from introducing a self-management plan, and one qualitative study<sup>14</sup> found that some adults with asthma were sceptical that self-management planning could help them control their asthma better.

We have developed a protocol for pre-discharge education supporting a peak expiratory flow (PEF) and symptom based self-management plan. In a randomised controlled trial we

tested whether this self-management programme offered in hospital to adults admitted with acute asthma was effective in reducing readmission and morbidity after discharge and whether it was acceptable to patients as part of their hospital management.

## METHODS

### Ethical approval and patient consent

The Joint Ethical Committee of Grampian Health Board and the Physicians' Committee of Aberdeen Royal Infirmary approved the study. General medical and respiratory physicians agreed that the respiratory nurse would visit patients if they were randomised to self-management planning.

### Subjects

The study was carried out in the seven general medical units and the respiratory unit of a 1022 bed teaching hospital. Patients aged 14–60 years admitted with acute asthma were identified and randomised. They were entered into the study between August 1997 and December 1999 and outcomes were followed for 12 months after discharge.

### Protocol

Patients were identified from daily visits to the wards and the hospital admissions database. Notes were checked to confirm asthma diagnosis and, if the patient fitted the study criteria (acute asthma and aged 14–60 years), they were randomised by selecting from random numbers held in sealed envelopes. Patients continued in their randomised group if readmitted over the following 12 months.

### Masking

Patients in the study were in the care of more than 40 physicians, both general medical and respiratory, who had all agreed at the beginning of the study to their patients being seen




## YOUR ASTHMA DISCHARGE PLAN

*These are the asthma medicines you should be taking when you leave hospital.  
Your GP may change this plan after seeing you.*

**With hindsight, when did your asthma start to get worse and what do you think you could have done to prevent this admission to hospital?**

**Plans for controlling asthma and preventing future attacks.**

<b>YOUR ASTHMA MEDICINES</b>	
<p>Your <b>RELIEF INHALER</b> is <input type="text"/></p> <p>This inhaler quickly helps mild breathlessness. It does not prevent bad attacks.</p>	<p>When you are well you should not need to use your relief inhaler more than 1 or 2 times a day or</p>
<p>Your <b>LONG ACTING RELIEF MEDICINE</b> is <input type="text"/></p> <p>This should be taken every day. It does not prevent bad attacks.</p>	<p>You should take ..... puffs ..... times every day.</p>
<p>Your <b>PREVENTION INHALER</b> is <input type="text"/></p> <p>This is an inhaled steroid. If you take it every day it helps you have little or no breathlessness. It also prevents sudden attacks.</p>	<p>You should take ..... puffs ..... times every day.</p>
<p><b>ORAL STEROID COURSE</b></p> <p>It is important to continue taking your inhaled steroid while you are taking any steroid tablets. See your GP if you are not back to normal after finishing your steroid tablets.</p>	<p>You should take every day after breakfast ..... tablets (..... mg) for ..... days ..... tablets (..... mg) for ..... days ..... tablets (..... mg) for ..... days then</p>
<p><b>ASTHMA WARNING SYMPTOMS</b></p> <p><b>When you return to normal you know your asthma is worsening</b></p> <ul style="list-style-type: none"> <li>• if you feel more breathless than usual and need to use your relief inhaler every two hours or more often</li> <li>• if you wake at night feeling breathless</li> <li>• <b>AND IF YOUR PEAK FLOW DROPS BELOW .....</b></li> </ul> <p><b>Remember 'What you can do'</b></p> <ul style="list-style-type: none"> <li>• <b>Act early. Don't wait until you are too breathless to do normal activities</b></li> <li>• <b>Double your usual inhaled steroid, or start tablet steroids when your peak flow drops</b></li> <li>• <b>Do not hesitate to contact your GP for guidance.</b></li> </ul> <p><b>A GOOD PEAK FLOW FOR YOU IS</b></p> <p><input type="text"/></p>	
<p><b>SEE YOUR DOCTOR IMMEDIATELY IF YOUR PEAK FLOW DROPS BELOW</b></p>	

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**Figure 1** Self-management plan.

by the respiratory nurse if randomised to intervention. The self-management programme was arranged independently of standard care, but it was not possible for physicians to be completely blind to whether individual patients were in the

standard care (SC) or self-management planning (SMP) group. Physicians were not formally notified as individual patients received the programme but a copy of the management plan was placed in patient notes for all SMP patients. Follow up in a

**Table 1** Baseline characteristics of subjects in the two groups (n=280)

	Total (n=280)	SMP (n=135)	SC (n=145)
Men	94 (34%)	54 (40%)	40 (28%)
Women	186 (66%)	81 (60%)	105 (72%)
Median (IQR) age (years)	29 (22–43)	31 (23–43)	29 (22–42)
Deprivation category*			
1–3	143 (54%)	72 (57%)	71 (51%)
4–7	124 (46%)	55 (43%)	69 (49%)
Current smoker	121 (43%)	66 (46%)	55 (41%)
Previous admission for acute asthma			
Never†	143 (51%)	72 (53%)	71 (49%)
Within 10 years	125 (45%)	57 (41%)	68 (45%)
Within 11–20 years	12 (4%)	6 (4%)	6 (5%)
Median (IQR) years since previous admission	2 (0–6)	2 (0–6)	2 (0–6)
Inhaled steroid prescribed before admission	221 (79%)	102 (76%)	119 (82%)
Chest clinic outpatient in 12 months before admission	63 (23%)	28 (21%)	35 (24%)
Median (IQR) admission PEF (% pred)	41.2 (30.6–55.8)	39.8 (30.8–54.2)	44.4 (30.6–54.7)
Admitted through A&E	76 (27%)	36 (27%)	40 (28%)

SMP=self-management programme; SC=standard care.

$\chi^2$  test for association for categorical variables, Mann-Whitney U test for continuous non-parametric variables.

\*n=267; categories 1–3 represent more affluent areas, 4–7 less affluent (Carstairs deprivation index<sup>15–18</sup>).

†Eight patients recalled asthma admissions more than 20 years before their present admission; breakdown was: 23 years previously, n=2; 24 years previously, n=1; 26 years, n=1, 28 years, n=1, 31 years, n=1; two "admitted as child" patients now aged over 40 years. These patients were included in the no previous admission group.

hospital outpatient clinic after discharge is recommended by BTS guidelines<sup>10</sup> and is usual for adult patients with acute asthma discharged from Aberdeen Royal Infirmary. Hence, for all patients entered into the study (intervention or control), hospital follow up remained at the discretion of their hospital doctor. The specialist respiratory nurse did not see patients in the study after their discharge from hospital.

The patients gave consent for their GP records to be reviewed in 12 months.

## Intervention

### Self-management programme (SMP) patients

The structured self-management programme was usually given to the patient in two visits, each lasting about 30 minutes, by a trained respiratory nurse (CC) with experience in patient education. During the visits the nurse discussed what asthma was and what happened during an asthma attack, how to recognise and avoid risk factors, and how medicines worked to control acute asthma. A booklet developed by the Chest Clinic was given to patients and they were encouraged to use the second visit to raise questions and concerns about their treatment. A written self-management plan based on the discharge medication prescribed by the patient's consultant was developed with the patient. It was emphasised that this management plan was for the immediate weeks after discharge, and that the plan might change when the patient saw his or her GP for review.

The plan was symptom and peak flow based. It instructed patients on leaving hospital to continue their oral steroids for the days advised, and to continue with the normal level of inhaled steroid, doubling the dose if symptoms of worsening asthma occurred or PEF fell below 80% of best or predicted. If the best PEF in the previous 2 years was available from the

patient's records this was used in preference to predicted PEF. Patients were advised to start oral steroids at 60% PEF. Those who did not have self-starting oral steroids were advised to contact their GP if PEF dropped below 60% or worsening symptoms occurred, as described in the plan. A copy of the patient self-management plan is shown in fig 1.

### Standard care (SC) patients

Patients in the standard care group were visited once by the respiratory nurse in order to gain their consent to their medical records being followed up in the next 12 months, and to being sent two questionnaires after they left hospital. No other intervention was made for SC patients who received care as directed by their physician. The study made no attempt to restrict education or management plans given by nurses, doctors, or pharmacists as part of usual care.

## Data collection

### Patient questionnaire

All patients (SMP and SC) were sent a postal questionnaire 4 weeks after discharge. This asked whether they had been given advice on using their medication and inhalers while in hospital, whether they found the advice helpful, and what their current symptoms were.

### Hospital records

An independent assessor (JF) blinded to patient assignment collected data on readmission within 12 months from hospital records.

## Outcomes

The primary outcome was readmission for acute asthma within 12 months. Secondary outcomes were patient morbidity at 1

**Table 2** Management at discharge (n=280)

	Total (n=280)	SMP (n=135)	SC (n=145)	p value
Inhaled steroids at discharge	267 (95%)	134 (99%)	133 (92%)	<0.01
Long acting $\beta_2$ agonist at discharge	100 (36%)	43 (32%)	57 (39%)	0.2
Oral steroids at discharge	264 (94%)	133 (98%)	131 (90%)	0.06
Hospital follow up appointment arranged	254 (91%)	132 (98%)	122 (84%)	<0.01

SMP=self-management programme; SC=standard care.

$\chi^2$  test for association for categorical variables.

**Table 3** Patient outcomes one month after discharge (n=226)†

	No (%)	SMP	SC	OR† (95% CI)	p value*
<i>All patients</i>	N=226	(n=108)	(n=118)		
<i>In the past week</i>					
No daytime wheeze	43 (19%)	29 (27%)	14 (12%)	2.6 (1.2 to 5.3)†	0.01
No night disturbance	101 (45%)	59 (55%)	42 (36%)	2.0 (1.2 to 3.5)†	0.01
No activity limitation	112 (50%)	60 (56%)	52 (44%)	1.5 (0.9 to 2.7)†	0.12
Asthma satisfactorily explained while in hospital	197 (87%)	108 (100%)	89 (76%)	NA§	0.000
Written management plan	133 (59%)	98 (93%)	35 (30%)	28.0 (12.3 to 63.8)	0.000
<i>First admission</i>	N=111	(n=57)	(n=54)		
<i>In the past week</i>					
No daytime wheeze	25 (22%)	20 (35%)	5 (9%)	4.9 (1.6 to 14.7)†	0.004
No night disturbance	57 (51%)	36 (63%)	21 (39%)	2.6 (1.2 to 5.6)†	0.02
No activity limitation	58 (52%)	32 (56%)	26 (48%)	1.3 (0.6 to 2.8)†	0.49
Asthma satisfactorily explained while in hospital	93 (84%)	57 (100%)	36 (67%)	NA§	0.000
Written management plan	75 (68%)	56 (98.2%)	19 (36.5%)	NA§	0.000
<i>Multi admission</i>	N=115	(n=51)	(n=64)		
<i>In the past week</i>					
No daytime wheeze	18 (16%)	9 (18%)	9 (14%)	1.2 (0.4 to 3.5)†	0.70
No night disturbance	44 (38%)	23 (45%)	21 (33%)	1.5 (0.2 to 9.0)†	0.33
No activity limitation	54 (47%)	28 (56)	26 (41%)	1.7 (0.8 to 3.8)†	0.17
Asthma satisfactorily explained while in hospital	104 (90%)	51 (100%)	53 (84%)	NA§	0.000
Written management plan	58 (50%)	42 (84%)	16 (25%)	15.4 (6.0 to 39.7)	0.000

SMP=self-management programme; SC=standard care.

\* $\chi^2$  test for association for categorical variables.

†Adjusted for inhaled steroid, oral steroid, hospital follow up at discharge.

‡226 patients responded to the one month post discharge questionnaire.

§ Odds ratios infinitely large.

month after discharge and patient satisfaction with the asthma explanation.

### Power of study and data analysis

Power was calculated for 300 patients. This gave 80% power to detect differences of 0.4 SD between groups for parametric data, or 12% difference for non-parametric category data. Data analysis used standard parametric and non-parametric tests ( $\chi^2$  tests) and calculated odds ratios using logistic regression techniques. Analysis was carried out using SPSS Version 9. Deprivation/affluence was assessed from postcodes using the Carstairs deprivation index<sup>15 16</sup> classified into categories by McLoone *et al.*<sup>17 18</sup>

### Data analysis: first v multi admission

A previous admission with acute asthma is a predictor of future risk of readmission.<sup>1-3 19</sup> Patients were asked if they had ever before been admitted to hospital with acute asthma. The date of the last admission was checked for those patients who had been admitted to a Grampian hospital. For 107 patients the previous admission date could be confirmed from Aberdeen hospital records; for the remaining 30 the date was based on patient recall only.

Patients with no previous asthma admission were classified as "first". We included in this group eight patients with an asthma admission which had occurred more than 20 years ago. The remaining patients had an asthma admission within the last 20 years and were classified as "multi". The number of months or years since the most recent admission was noted.

## RESULTS

### Patient entry and follow up

Two hundred and eighty patients were entered into the trial and followed for 12 months between August 1997 and December 2000. This was 60% of all eligible patients admitted with acute asthma over the study period. At 12 months 271 (97%) patients were still living in the Grampian district and data on readmissions were gathered from hospital records.

Table 1 shows the baseline characteristics of patients in the study. SMP and SC patients did not differ in age, deprivation category, smoking history, previous admission history, out-patient attendance, or admission PEF, but there were more women in the SMP group (p=0.03).

### Management at discharge

The programme appeared to increase the prescribing of oral and inhaled steroids at discharge and at the follow up appointment, as shown in table 2.

### Patient admission history: first v multi admission\*

Having had a previous admission for acute asthma (first v multi) was a significant covariate of readmission risk (OR 3.6, 95% CI 1.9 to 6.9). The risk of readmission was not significantly associated with length of time since the previous admission. 72% of patients with a previous admission were managed in a respiratory ward compared with 66% of patients with no previous admission (p=0.29, NS).

### Morbidity and readmission at 1 month after discharge

One month after discharge four control patients and one intervention patient had been readmitted (p=0.4, Fisher's exact test). Two hundred and sixty six patients (95%) replied to a postal questionnaire sent 1 month after leaving hospital. SMP patients had fewer day and night symptoms than SC patients; this difference remained significant when odds ratios were adjusted for differences in discharge medication. Table 3 shows that the effect of the intervention was greater for patients for whom this had been the first admission.

\*Among the 12 patients admitted more than 10 years ago and included in the "multi" admission group were two control patients who were readmitted. No intervention patients were readmitted. We judged that inclusion of the 12 patients in the "multi" group was the most conservative approach to analysis.

**Table 4** Readmission within 12 months of discharge (n=271)\*

	Total (%)	SMP	SC	OR (95% CI)	p value
All patients	N=271	(n=131)	(n=140)		
Readmitted within 12 months	60 (22%)	22 (17%)	38 (27%)	0.5 (0.3 to 1.0)	0.04
First admissions	N=137	(n=69)	(n=68)		
Readmitted within 12 months	16 (12%)	3 (4%)	13 (19%)	0.2 (0.1 to 0.7)	0.01
Multi admissions	N=134	(n=62)	(n=72)		
Readmitted within 12 months	44 (33%)	19 (31%)	25 (35%)	0.8 (0.4 to 1.6)	0.62

SMP=self-management programme; SC=standard care.

\*Nine patients (five SC and four SMP) were lost to 12 month follow up of hospital records.

### Patient satisfaction

SMP patients were more satisfied with their hospital explanation of asthma (table 3). Since this may be biased by the likelihood that dissatisfied patients would not return their 1 month questionnaire, we also calculated satisfaction rates over all patients. The difference between SMP and SC patients remained significant, with 80% (108/135) of SMP and 61% (89/145) of SC patients satisfied ( $p<0.05$ ).

### Readmission over 12 months

Table 4 shows that during the following 12 months SMP patients were less likely than SC patients to be readmitted. At 12 months the differences between the two groups of patients remained greater for those for whom this had been a first admission.

### DISCUSSION

In this study a self-management programme was provided by a specialist respiratory nurse to adult patients admitted with acute asthma under the care of 40 physicians in all general medical and respiratory wards in a large teaching hospital. Patients who took part in the programme had significantly less morbidity at 1 month after discharge and were less likely to be readmitted during the following 12 month period.

Jones *et al*<sup>14</sup> found that patients who were “naïve” to self-management plans did not believe they would find them helpful, but patients in this study were highly satisfied with the programme. At least 80% of patients in the self-management programme were satisfied with the explanation of their asthma given to them in hospital compared with 61% of those who received standard care.

Only four patients refused to take part in the self-management programme compared with rates of 50% drop out or refusal in other trials of self-management programmes given in outpatient settings. For this reason the patients in the programme were probably more representative of admitted patients than has been the case in other educational interventions.<sup>9</sup> In particular, they were relatively young with a mean age of 29 years. Younger adult patients are significantly less likely to attend asthma education programmes.<sup>8</sup>

Although multi admission patients judged that the self-management plan and explanation had been helpful to them, they may have had less benefit from it. There was a difference in size of effect for first and multi admission patients in day and night morbidity at 1 month which persisted in the 12 month readmission data. This post hoc analysis must be treated cautiously, but previous studies have shown that admission history is a significant correlate of risk of readmission. A much larger sample size would be necessary to demonstrate statistical significance for the observed effects, which might nevertheless be of clinical importance.

If the observed difference is valid, might the lesser benefit for patients with a previous admission be due to the plan recommending action that did not help these patients? The self-management plan used in the programme recommended doubling inhaled steroid if PEF fell below 80% or symptoms increased and starting oral steroids if PEF fell below 60%. This

might not have been effective for patients with more severe or variable asthma. Quadrupling the dose of inhaled steroid has been suggested for preventing exacerbations in patients on moderate doses,<sup>20</sup> and patients with multiple admissions for asthma may not benefit from doubling prophylaxis at warning signs. On the other hand, the multi admission group may differ in attitudes to self-management.<sup>21</sup> Adams *et al*<sup>22</sup> found that patients with multiple admissions had lower preference for autonomy in asthma management decisions and were less likely to have a management plan. Patients with multiple admissions may have attitudes to self-management which were not addressed by this programme.

It is important in evaluating patient centred interventions that we do not confuse benefits from improved medical management for patients in the study with benefits from the intervention itself. In this study the medical management of SC patients (controls) was close to optimal by guideline recommendations<sup>11</sup> (92% on inhaled steroids at discharge, 90% prescribed oral steroids, 84% with outpatient follow up), but nonetheless was below that for the SMP group (99% on inhaled steroids, 98% on oral steroids, 98% with follow up). This difference in medical management at discharge might explain the apparent benefit of the self-management programme. The statistical analysis showed this was not the case. Adjusting for differences in medical management at discharge had only a minor effect on the outcomes and SMP patients still showed significant benefit with less morbidity and reduced readmissions than SC patients.

How do we explain the apparent effect of a patient centred self-management programme on doctor's management? We think this came about because the respiratory nurse occasionally noted omissions in discharge medication prescribed for intervention patients and queried this with ward staff. Smith *et al*<sup>23</sup> evaluated the role of a specialist asthma nurse in training ward staff in best practice and found that the training programme had no effect on oral steroid administration, inhaled prophylaxis, or arrangements for hospital follow up. In contrast, the present study suggests that developing a self-management plan with patients improves medical management adherence to guidelines. We suggest that creating a self-management plan with a patient directs attention to any gaps in prescribing at discharge which can then be corrected.

The main conclusion of this study must be that it is possible to deliver effective self-management support with a nurse led intervention during the patient's hospital stay which does not entail special follow up or support after discharge. The programme can be given to patients in non-respiratory wards as well as respiratory wards, and to patients who are being cared for by general physicians. A programme given during hospital stay is well accepted by patients and reaches more people than outpatient programmes after discharge. Some questions have been raised by the study—in particular, whether the plan was of more benefit for patients at their first admission and, if so, whether this was due to the “doubling” direction of the plan being less appropriate for multiple admission patients or to sociopsychological differences between first and multiple admission patients. This needs

further exploration. If true, the results suggest that a first admission may be the most effective time to provide education in self-management to patients admitted with asthma.

## ACKNOWLEDGEMENTS

The authors thank the patients who took part in this study and appreciate the helpful statistical advice given by Sivasubramaniam Selvaraj, Biostatistician of the Highlands and Islands Health Research Institute, University of Aberdeen and Neil Scott of the Department of Public Health, University of Aberdeen. They also thank Mrs J Fiddes, Asthma Care Coordinator, Aberdeen Royal Infirmary, and Ms M Jaffray, Research Assistant, for their assistance with collecting data for the study.

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Liesl Osman, Christine Calder, Graham Douglas are guarantors for the paper.

The study was funded by the NHS R & D Programme in Delivery of Care in Asthma, managed by the National Asthma Campaign. The Health Economics Research Unit is funded by the Chief Scientist Office, Scottish Executive Health Department. The views expressed in this paper are those of the authors and not those of the funding bodies.

Conflicts of interest: none.

## REFERENCES

- Information and Statistics Division (ISD) Scotland.** Readmission within 12 months for acute asthma: 1990–1996. Available at [http://www.show.scot.nhs.uk/isd/Scottish\\_Health\\_Statistics](http://www.show.scot.nhs.uk/isd/Scottish_Health_Statistics) 1999.
- Slack R, Bucknall CE.** Readmission rates are associated with differences in the process of care in acute asthma. *Qual Health Care* 1997;**6**:194–8.

- Wesseldine LJ, McCarthy P, Silverman M.** Structured discharge procedure for children admitted to hospital with acute asthma: a randomised controlled trial of nursing practice. *Arch Dis Child* 1999;**80**:110–4.
- Ignacio-Garcia JM, Gonzalez-Santos P.** Asthma self-management education program by home monitoring of peak expiratory flow. *Am J Respir Crit Care Med* 1995;**151**:353–9.
- Lahdensuo A, Hahtela T, Herrala J, et al.** Randomised comparison of guided self management and traditional treatment of asthma over one year. *BMJ* 1996;**312**:748–52.
- Gallefoss F, Bakke PS.** Impact of patient education and self-management on morbidity in asthmatics and patients with chronic obstructive pulmonary disease. *Respir Med* 2000;**94**:279–87.
- Cote J, Cartier A, Robichaud P, et al.** Influence on asthma morbidity of asthma education programs based on self-management plans following treatment optimization. *Am J Respir Crit Care Med* 1997;**155**:1509–14.
- Abdulwadud O, Abramson M, Forbes A, et al.** Attendance at an asthma educational intervention: characteristics of participants and non-participants. *Respir Med* 1997;**91**:524–9.
- Yoon R, McKenzie DK, Miles DA, et al.** Characteristics of attenders and non-attenders at an asthma education programme. *Thorax* 1991;**46**:886–90.
- British Thoracic Society.** The British guidelines on asthma management: 1995 review and position statement. *Thorax* 1997;**52** (Suppl 1):S1–21.
- Bucknall CE, Ryland I, Pearson MG, et al.** National benchmark for clinical governance. *J R Coll Physicians Lond* 2000;**34**:52–6.
- Cote J, Bowie DM, Robichaud P, et al.** Evaluation of two different educational interventions for adult patients consulting with an acute asthma exacerbation. *Am J Respir Crit Care Med* 2001;**163**:1415–9.
- Ayres JG, Campbell LM.** A controlled assessment of an asthma self-management plan involving a budesonide dose regimen. OPTIONS Research Group. *Eur Respir J* 1996;**9**:886–92.
- Jones A, Pill R, Adams S.** Qualitative study of views of health professionals and patients on guided self management plans for asthma. *BMJ* 2000;**321**:1507–10.
- Morris R, Carstairs V.** Which deprivation? A comparison of selected deprivation indexes. *J Public Health Med* 1991;**13**:318–26.
- Carstairs V.** Deprivation indices: their interpretation and use in relation to health. *J Epidemiol Community Health* 1995;**49**(Suppl 2):S3–8.
- McLoone P, Boddy FA.** Deprivation and mortality in Scotland, 1981 and 1991. *BMJ* 1994;**309**:1465–70.
- McLoone P.** Targeting deprived areas within small areas in Scotland: population study. *BMJ* 2001;**323**:374–5.
- Mitchell EA, Bland JM, Thompson JM.** Risk factors for readmission to hospital for asthma in childhood. *Thorax* 1994;**49**:33–6.
- Foresi A, Morelli MC, Catena E.** Low-dose budesonide with the addition of an increased dose during exacerbations is effective in long-term asthma control. On behalf of the Italian Study Group. *Chest* 2000;**117**:440–6.
- Osman LM, Friend JA, Legge JS, et al.** Requests for repeat medication prescriptions and frequency of acute episodes in asthma patients. *J Asthma* 1999;**36**:449–57.
- Adams RJ, Smith BJ, Ruffin RE.** Factors associated with hospital admissions and repeat emergency department visits for adults with asthma. *Thorax* 2000;**55**:566–73.
- Smith E, Alexander V, Booker C, et al.** Effect of hospital asthma nurse appointment on inpatient asthma care. *Respir Med* 2000;**94**:82–6.