

Trial of a "credit card" asthma self-management plan in a high-risk group of patients with asthma

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Background: The "credit card" asthma self-management plan provides the adult asthmatic patient with simple guidelines for the self-management of asthma, which are based on the self-assessment of peak expiratory flow rate recordings and symptoms.

Objective: The study was a trial of the clinical efficacy of the credit card plan in a high-risk group of asthmatic patients.

Methods: In this "before-and-after" trial, patients discharged from the emergency department of Wellington Hospital, after treatment for severe asthma were invited to attend a series of hospital outpatient clinics at which the credit card plan was introduced. Questionnaires were used to compare markers of asthma morbidity, requirement for emergency medical care, and medication use during the 6-month period before and after intervention with the credit card plan.

Results: Of the 30 patients with asthma who attended the first outpatient clinic, 26 (17 women and 9 men) completed the program. In these 26 participants, there was a reduction in both morbidity and requirement for acute medical services: specifically, the proportion waking with asthma more than once a week decreased from 65% to 23% ($p = 0.005$) and the proportion visiting the emergency department for treatment of severe asthma decreased from 58% to 15% ($p = 0.004$). The patients attending the clinics commented favorably on the plan, in particular on its usefulness as an educational tool for monitoring and treating their asthma.

Conclusions: Although the interpretation of this study is limited by the lack of a randomized control group, the findings are consistent with other evidence that the credit card asthma self-management plan can be an effective and acceptable system for improving asthma care in a high-risk group of adult patients with asthma. (*J Allergy Clin Immunol* 1996;97:1085-92.)

Key words: Asthma, self-management plan, asthma education

Adult patients with asthma who are frequently seen in emergency departments for treatment of acute asthma have an increased risk of death.¹ Patients in this high-risk group perceive the emergency department as the most appropriate place for the management of deteriorating asthma and

Abbreviation used

PEFR: Peak expiratory flow rate

often self-refer late in the attack with life-threatening asthma.² They also tend to poorly utilize available general practitioner services for the long-term management of their asthma, instead using the emergency department as a primary care facil-

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TABLE I. Characteristics of participants enrolled in the study ($n = 30$)

Use of medical services	
Visit to general practitioner	
Pick up a prescription	93% (28)
Routine appointment	43% (13)
Emergency	37% (10)
Hospital emergency department visits	60% (18)
Hospital admissions	13% (4)
Asthma morbidity	
Awakened by asthma symptoms more than once a week	73% (22)
One day or more "out of action"	63% (19)
Asthma management	
Course of prednisone	60% (18)
Emergency nebulized medications	63% (19)
Prescribed inhaled steroid*	67% (20)
Prescribed oral bronchodilators*	20% (6)
Peak flow meter*	60% (18)
Written plan*	13% (4)
Socioeconomic factors	
Smoker*	27% (8)
Beneficiary*	10% (3)

The measures documented relate to the 12 months before the index hospital emergency department visit for treatment of severe asthma. As a result, the measures exclude the episode that resulted in a visit to the emergency department and led to referral to the asthma clinic.

"Out of action" denotes any day a patient was unable to perform usual activities (e.g., spent off work or in bed because of asthma).

*At time of initial interview (all other measures for preceding 12 months).

ity.³ Other features that characterize this high-risk group include noncompliance with prescribed medications,⁴ low use of inhaled preventive therapy, overreliance on bronchodilator therapy, and high morbidity rates.⁵ In many respects, these frequent emergency department patients represent a group whose needs are not being met by our traditional health care system and who may require an alternative approach.

The attainment of skills in self-assessment and appropriate self-management of deteriorating asthma is one way in which the morbidity rate of this group of frequent emergency department patients could be reduced. The credit card asthma self-management plan is a system designed to facilitate the acquisition of such skills. The credit card plan, which was developed and adopted in New Zealand⁶ and has more recently been promoted with minor modifications through the National Asthma Campaigns of Australia and the United Kingdom, uses guidelines for the self-management of asthma based on patient self-

assessment of peak expiratory flow rate (PEFR) recordings and symptoms. Clear instructions on what self-management steps to take and when to seek help are tailored to individual patients and their requirements and written directly on the plastic credit card.

We have recently shown that this credit card plan is an effective system for the management of asthma in a rural Maori community experiencing major health problems with asthma.⁷ This study extends these original observations by examining the effects of the plan's introduction, through a series of hospital-based outpatient clinics, in another high-risk group of patients with asthma, those who are treated in a hospital emergency department.

METHODS

Participant selection

From February to October 1991 casualty officers at Wellington Hospital invited adult patients with asthma who were treated for severe asthma in the emergency department and discharged, to attend a free "specialist" hospital outpatient clinic the following week. Patients who attended this initial outpatient clinic were enrolled in the trial if they lived in the Wellington region, had no uncontrolled concomitant medical problems, and were not being seen by a specialist chest physician. Patients who initially accepted an invitation by the casualty officer but did not attend the first outpatient clinic were again invited by telephone to attend the clinics on at least two other occasions before being considered ineligible.

Participant characteristics

The 30 participants enrolled in the study had a mean age of 31 years (range, 17 to 69 years); 21 (70%) were women, and 20% were Maori or Pacific Islanders. All but one of the 30 participants self-referred to the emergency department, and 18 (61%) were first seen between the hours of 6:00 PM and 6:00 AM. Table I provides a summary of the characteristics of the 30 patients enrolled in the study. In the preceding 12 months there was considerable morbidity experienced, with 73% of patients reporting that they were awakened by symptoms of asthma, on average, more than 1 night per week. Problems with the appropriate use of health services were reflected by the frequent use of hospital emergency services (58%) yet relatively infrequent attendance for routine asthma consultations (43%). Although a relatively high number of patients had peak flow meters (60%) in this group, few (13%) had a written management plan.

Study design

The initial study design was that of a controlled clinical trial, with patients randomized to an "intervention" group (receiving the credit card plan, associated

asthma education, and outpatient clinic review) and a "control" group (receiving clinic review only). However, one of the first patients who was randomly assigned to the control group had severe asthma with: four admissions to hospital in the previous 2 years, four emergency department visits in the last 6 months, waking with symptoms of asthma, on average, every night for the last year, and requiring administration of salbutamol by metered-dose inhaler an average of 10 times a day, despite being prescribed beclomethasone dipropionate in a daily dose of 2000 μ g. It was believed that this patient would be exposed to an unacceptably high risk of serious morbidity and death if intensive medical intervention was not attempted. After discussing this problem with the Wellington Area Health Board Ethics Committee, we were instructed to drop the control group and include all patients in the active intervention group.

Thus the final study design was a 6-month retrospective comparison of markers of asthma morbidity (nights awakened, days out of action), requirement for acute medical treatment (hospital admissions, visits to hospital emergency department, emergency visits to general practitioner) and medication use (courses of prednisone, requirements for emergency nebulized medications, and bronchodilator canister duration) before and after the introduction of the credit card asthma self-management plan. To counteract the possibility of "regression to the mean," we excluded the index visit to the emergency department (and its associated use of acute medical services and medications), which resulted in participant enrollment in the study.

The hospital outpatient clinics were run as a series of three educational/therapeutic sessions by one of three hospital specialists or a medical registrar at 0, 1, and 3 months. After the initial clinic visit, participants were given a peak flow meter (if they did not already have one) and were instructed to complete a daily diary of the best value from two morning peak flow recordings before bronchodilator use for a period of 1 month. After this initial 1-month period, the self-management plan was introduced at a clinic by one of the four doctors in the study team. Additional nonemergency clinic appointments were made if participants required further alteration to their medications to establish a "personal best" PEFR.

The participants attended the final clinic at 3 months and were followed up for a total of 6 months. The clinics were held free of charge, initially in the outpatient department of Wellington Hospital, and after the introduction of hospital user "part charges" in February 1992, at the Wellington School of Medicine. The general practitioner of each participant was informed of his or her patient's involvement in the study, and notes were sent regarding progress during the study period and at the conclusion. The study was approved by the Wellington Area Health Board Ethics Committee, and all patients gave written informed consent.

The clinics focused on these key points: the inflam-

matory basis of asthma, the use of regular inhaled steroids to reduce the frequency and severity of attacks, the use of bronchodilators for relief of symptoms or before exposure to known aggravating stimuli (rather than according to a regularly scheduled regimen), adequate drug delivery through appropriate inhaler technique or change to dry powder or spacer delivery systems, the recognition of unstable asthma through the educated interpretation of symptoms and PEFR measurements, and appropriate self-management through the use of the credit card plan.

At the conclusion of the study, 6 months after the introduction of the plan, an additional questionnaire was also used to assess the acceptability of the plan. The questionnaire was structured with both direct and open-ended questions and was administered by three research assistants, previously unknown to the participants.

The adult asthma self-management plan

The self-management plan provided two methods of self-assessment of asthma control: subjectively with symptoms and objectively with PEFR. The method for self-assessment with PEFR was printed on one side and the symptoms-based approach was printed on the reverse side of a small plastic card, the size of a standard credit card (Fig. 1).

For both methods of assessment, there are four general stages in which treatment guidelines are recommended, on the basis of either the development of increasingly severe symptoms or a decrease in PEFR from the patient's previous "best" (Table II). The best PEFR was taken as the higher of either the maximum consistent PEFR recorded before bronchodilator use in the diaries or the predicted value taken from standard tables.

For each stage, clear instructions were written on what self-management steps to take and when to seek help. These were tailored to individual patients and their requirements and were written directly on the card. Similarly, the patient's individual therapy, inhaled steroid or bronchodilator, and the name and telephone number for emergency assistance was also written on the card. Details of the plan are provided in the Appendix.

Analysis of results

For markers of morbidity, emergency medical visits, and medication use, the outcome measures were compared for the 6-month period before and the 6-month period after intervention by two statistical methods: McNemar's test (with Yates' correction for continuity) was used to compare the frequency participants changed above or below a defined level, and the Wilcoxon signed-rank test was used for paired nonparametric data.⁸ Finally, at the end of the study, a descriptive evaluation of each participant's self-management behav-

ASTHMA ACTION PLAN			
Name: _____		ISSUE DATE _____	
	PEAK FLOW	TREATMENT	
1	BEST =	▶	Continue regular treatment
2	<80% =	▶	Double dose of:
3	<60% =	▶	Start prednisone & ring Doctor
4	<40% =	▶	Call emergency Dr or Dial 111 for ambulance

	SYMPTOMS	▶	TREATMENT
1	Asthma under control	▶	Continue regular treatment
2	Waking with asthma at night	▶	Double dose of:
3	Increasing breathlessness or poor response to	▶	Start prednisone & ring Doctor
4	Severe attack	▶	Call emergency Dr or Dial 111 for ambulance

Contact Dr: _____ Tel: _____

FIG. 1. The adult credit card asthma self-management plan.

ior and perception of the credit card plan was also conducted.

RESULTS

Attendance

During the 8-month recruitment period, 223 adult patients with severe asthma were treated and discharged from the emergency department of Wellington Hospital. Thirty-nine percent (86) of this target population accepted an invitation to attend the asthma clinic. Of these, 38 (44%) eventually attended the initial appointment, and 30 (35%) were considered eligible and were enrolled in the trial. Four subjects did not complete the trial: one withdrew because she had a recent diagnosis of myalgic encephalopathy, one moved outside the Wellington region, and two were lost to follow-up.

Asthma morbidity and use of emergency medical services

A comparison of the 6-month periods before and after intervention with the credit card plan showed a significant reduction in markers of asthma morbidity and in the requirement for acute medical services (Tables III and IV). Specifically, the proportion of patients awakening with asthma more than once a week decreased from 65% to 23% ($p = 0.005$), and the proportion visiting the emergency department with severe asthma decreased from 58% to 15% ($p = 0.004$). This improvement was also reflected in the proportion of patients who improved versus those who deteriorated with respect to the number of nights awakened by symptoms of asthma per week (54% vs 12%, $p = 0.002$) and the

TABLE II. The adult credit card asthma self-management plan

Step	Peak flow	Symptoms	Action
1	80%-100% of best	Intermittent/few	Continue regular inhaled corticosteroid; take bronchodilator for relief of symptoms.
2	60%-80% of best	Waking at night with asthma or coughing	Double the dose of inhaled corticosteroid.
3	40%-60% of best	Increasing breathlessness or poor response to bronchodilator	Start oral steroids and contact a doctor.
4	<40% of best	Severe attack	Call emergency doctor or ambulance immediately.

At all stages, take inhaled bronchodilator for relief of symptoms.

TABLE III. Comparison of study participants 6 months before and 6 months after introduction of the credit card plan ($n = 26$)

	Before	After	<i>P</i> Value
Use of medical services			
Emergency visit to general practitioner	27% (8)	12% (3)	0.17
Emergency department visit	58% (15)	15% (4)	0.004
Asthma morbidity			
Awakened by asthma symptoms >1 night/wk	65% (17)	23% (6)	0.005
One day or more "out of action"	58% (15)	17% (5)	0.01
Use of medication			
Mean dose of inhaled steroid			
Aerosol (μg)	633 (18)	1317 (24)	<0.001
Dry powder (μg)	800 (1)	1200 (2)	0.75
Bronchodilator canister duration			
More than 4 weeks	27% (8)	77% (20)	0.002
Course of prednisone	42% (11)	50% (13)	0.78
Emergency nebulized medications	50% (13)	27% (7)	0.15

number of emergency department visits (46% vs 4%, $p = 0.02$). The greatest benefit was observed in those with the greatest morbidity rate and most frequent use of emergency medical services.

Use of medication

The mean prescribed dose of inhaled steroids increased by twofold; the number of participants whose bronchodilator canister lasted more than 4 weeks increased threefold. The reduction in requirement for emergency nebulized medications was not significant, and there was no change in the proportion of participants requiring a course of prednisone (Tables III and IV).

Self-management behavior

Of the 26 study participants who completed the trial, 20 (77%) stated that they had used the instructions on the credit card to increase the amount of inhaled steroid. Of the 10 participants who required a course of prednisone in the last 3 months of the study, six (60%) had self-initiated the treatment, and four (40%) had initiated treatment with the assistance of a doctor.

Acceptability of the credit card plan

The study participants were positive about the credit card plan, specifically its usefulness in teaching them to monitor and treat their asthma. Of the 24 who had experienced a "bad attack" of asthma, 13 (50%) found both sides of the card (peak flow

TABLE IV. Comparison of study participants 6 months before and 6 months after introduction of the credit card plan ($n = 26$)

	Increased	Decreased	<i>p</i> Value
Use of medical services			
Emergency visits to general practitioner	8% (2)	27% (7)	0.11
Emergency department visits	4% (1)	46% (12)	0.02
Asthma morbidity			
Nights awakened by asthma symptoms per week	12% (3)	54% (14)	0.002
Days "out of action"	4% (1)	54% (14)	0.002
Use of medication			
"Reliever" canister duration	15% (4)	58% (15)	0.02
Courses of prednisone	27% (8)	27% (8)	0.25
Emergency nebulized medications	12% (3)	27% (8)	0.16

and symptoms) equally helpful, and 11 (42%) found the peak flow side of the card more helpful. With regard to the plan's content, 14 (54%) believed it should not be greater and 24 (92%) that it should not present any more detail.

DISCUSSION

In this study we have found that the introduction of the credit card asthma self-management plan through a system of hospital-based specialist clinics is an effective method for improving asthma care in a high-risk group of emergency department patients. This high-risk group is characterized by many problems in long-term management, which are not met by the traditional health care system. Despite these difficulties, this program led to a decrease in asthma morbidity, as reflected in a 65% reduction in the proportion of participants awakened by symptoms of asthma and a decrease in the requirement for acute medical services, with a 75% reduction in emergency department visits.

These results should be interpreted with caution for a number of reasons. Most importantly there was no randomized control group, and so it is not possible to determine the relative importance of the different features of the plan or whether the system of specialist-based clinics may have contributed to the improvement observed. It was particularly disappointing that we had to abandon our initial study design, which included a control group that did not receive the intervention "package" of asthma education and the credit card plan. However, as outlined in detail in the Methods section, we were concerned that one of the first patients with severe asthma, who was randomly assigned to the control group, would be exposed to an unacceptably high risk of serious morbidity if intensive

medical intervention was not attempted. After discussion with members of the ethical committee, we followed their advice that all patients be included in the active intervention group.

Another potential problem with the interpretation of this study is the phenomenon of "regression to the mean" in which subjects recruited during an "illness phase," improve independently of any interventional factor. However, recent evidence suggests that an emergency department visit reflects preexisting long-term poor management,⁹ which is unlikely to spontaneously improve. Nevertheless, to counteract any potential effect of regression to the mean, we have used 6-month periods and excluded the index visit to the emergency department (with its associated use of acute medical services and medications) that resulted in subsequent enrollment in the study.

We may be criticized for relying on 6-month recall for the retrospective markers of asthma morbidity and health service utilization contained in our self-reported questionnaires, rather than other more "objective" sources (such as medical records), to demonstrate the effect of the credit card plan. However, two previous studies have confirmed that this method (for a longer, 12-month recall period) is highly consistent with an assessment based on medical records, health insurance data, or doctor-assessed morbidity for measuring days absent from school or work, outpatient attendance, and hospitalization days.^{10,11} Other indices of morbidity, such as frequency of attacks, were also found to be closely associated with doctor-assessed morbidity. Thus if one can assume that these objective measures are accurate, our questionnaire findings probably represent a meaningful measure of asthma control in this group of patients.

Data from this study suggest that the more regular use of an appropriate (higher) dose of inhaled steroids made a significant contribution to the improvements noted. It could be argued that similar results could have been achieved by simply increasing the dose of inhaled steroids for all patients. However, we consider that only by providing specific self-assessment criteria by which prophylactic therapy could be increased or decreased, was it possible to determine the most suitable dose of inhaled steroids for each patient. The evidence that an early increase of inhaled steroids (stage 2 of the credit card plan) reduces the severity of an asthma exacerbation is not strong.¹² However, this recommendation is consistent with the International Consensus Guidelines,¹³ which propose that the regular dose of inhaled corticosteroids be increased in the case of unstable asthma (recognized by the presence of nocturnal symptoms and PEFs of 60% to 80% of predicted value). Thus the credit card plan can be used to titrate the appropriate therapeutic dose of inhaled corticosteroids required to maintain optimal short- and long-term control of a patient's asthma within the framework of a simple stepwise system. As the patient gains proficiency in self-management, these dosage adjustments can be done with minimal medical assistance. For example, in the final 3 months of the study, about three quarters of participants increased the amount of inhaled steroids in accordance with the instructions on the card. Similarly, 60% of those requiring a course of prednisone self-initiated this therapy when they experienced severe asthma.

One of the features of the program was that therapeutic changes were not introduced in isolation but as part of an integrated system of asthma education and management. This integrated approach makes it difficult, but perhaps not necessary, to determine the relative contribution of the different components of the intervention that led to improved asthma control. The emphasis of the program was on the attainment of individualized self-management skills, rather than the acquisition of general knowledge. This approach is thought to facilitate long-term behavioral change¹⁴ and may be one important reason that this and other self-management skills-based programs^{7, 11, 15-17} have led to improved asthma control, whereas asthma education programs that are solely knowledge-based have tended to be disappointing.¹⁸⁻²⁰

As observed in our previous study of the credit card plan in a rural Maori community,⁷ most

patients preferred using a combination of both PEFs and symptoms when self-managing acute exacerbations and did not want a more detailed or complicated plan. Although the rationale for the objective assessment of asthma severity is well established,²¹⁻²³ recent evidence suggests that the interpretation of key symptoms is also valuable in detecting asthma exacerbations early.²⁴ As a result, we would recommend that self-management guidelines be provided in a simple format and that both symptoms and PEFs be used to identify changes in asthma severity.

The small proportion of our study sample relative to the target population of all high-risk patients with asthma who are treated in hospital emergency departments (12%) suggests that our sample was self-selected and makes it difficult to generalize our results beyond the study participants. Previous research in Australia suggests that asthma severity, asthma knowledge, and self-management practices may not be explanatory variables for nonattendance at hospital asthma education programs.²⁵ Although factors influencing the recruitment of subjects in this study are uncertain, it is likely that patients in this subgroup are relatively motivated to improve their asthma control.

Finally, this study provides further insights into the factors leading to high morbidity and mortality rates in this group of emergency department patients. Characteristic features of this high-risk group included a high prescription rate versus routine consultation rate in general practice, emergency department self-referral, predominance of out-of-hours consultations, and the high proportion of the target population who either did not accept an invitation or failed to attend the initial asthma clinic appointment. These features suggest that in this group of patients the appropriate use of asthma services represents a major problem, which may not be overcome by merely providing a "free" hospital-based service. Thus even though we were able to significantly reduce the morbidity of those patients with asthma who attended our clinics, we still did not deliver any asthma services to the majority of eligible patients. Thus alternatives to such hospital-based and traditional general practice-based care are required.

We conclude that despite these problems in service accessibility, the credit card asthma self-management plan, when used as part of an asthma educational program, can be an effective and acceptable system for improving asthma care in a high-risk group of adult patients with asthma.

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APPENDIX: ASTHMA SELF-MANAGEMENT WITH THE CREDIT CARD PLAN

1. If a person had few symptoms and PEFR was greater than 80% of "best" (step 1 on the plan), he or she was instructed to use regular treatment, which usually consisted of inhaled steroids taken twice daily and inhaled β -agonist as required for relief of symptoms.
2. If a person was waking up at night with asthma or if PEFR was less than 80% of "best" (step 2 on the plan), he or she was instructed to double the dose of inhaled steroid for the number of days required to reach step 1, continue this increased dose for the same number of days, and then return to the previous maintenance dose.
3. If a person was experiencing increasing breathlessness, if he or she had a poor response to the bronchodilator, or if PEFR was less than 60% of "best" (step 3 on the plan), the person was instructed to start using the home supply of oral prednisone 30 to 40 mg daily and contact his or her general practitioner. Prednisone administration was continued at this dose for the number of days required to reach step 1, then reduced to 15 to 20 mg daily for the same number of days before it was stopped.
4. If despite these actions, the attack of asthma became even more severe and PEFR fell to less than 40% of "best" (step 4 on the plan), the person was instructed to seek emergency medical help immediately.