

Prospective controlled evaluation of the effect of a community based asthma education centre in a multiracial working class neighbourhood

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Abstract

Background - Previous work has indicated a high rate of non-attendance at hospital based clinics among young, multiracial asthmatic patients of lower socioeconomic class. The efficacy of delivering asthma education from a community health centre established in a multiracial working class neighbourhood was evaluated.

Methods - A prospective controlled study was performed in which asthmatic subjects aged between two and 55 years attending a hospital emergency room with acute asthma and living within a defined geographical area of high emergency room users were randomised to the usual follow up or the education centre plus usual follow up. Measurements were taken at entry into the study and again nine months later.

Results - At nine months patients randomised to the education centre had more preventive medications, more peak expiratory flow meters and better flow meter technique, more self-management plans, better knowledge of appropriate action to take when confronted with worsening asthma, less nocturnal awakening, and better self-reported asthma control than the control group. There was no difference between the study groups in measurements of compliance, hospital admission, days lost from school or work, or emergency room use.

Conclusions - The main effects of education were on asthma knowledge and self-management skills, whilst improvements in asthma morbidity were small. Potential reasons for this include heterogeneous study population (in terms of baseline self-management skills, asthma severity, ethnicity and age), pragmatic study design, insensitivity of many of the measurements of morbidity, the modest effectiveness of a single time limited education programme, and inability to limit the effects of such a large community based study to the intervention group (there was a 67% reduction in asthma admissions during the study period from the geographical area targeted compared with a 22% reduction for the rest of Auckland).

amongst the highest in the world. A previous study² has shown that, within Auckland (New Zealand's largest city), mortality and admission rates for asthma are highest in the South Auckland district, an area recognised as having high social and medical needs and a large immigrant (predominantly Pacific Island) population. Asthma mortality and admission rates in Auckland are four times higher in Pacific Islanders than Europeans, with Maoris being intermediate.^{2,3} Maoris and Pacific Islanders make up 23.9% of the South Auckland district population but 67% of asthma admissions and emergency room attendances.⁴ The increased use of the emergency room by Maoris and Pacific Islanders appears to relate more to social, cultural and financial reasons and to a lack of self-management skills and information about asthma, than to differences in asthma severity.⁴ A free, specialist-run, hospital-based asthma clinic was established in South Auckland to target at-risk asthmatic subjects. Of patients referred to the clinic 30% did not attend and, when compared with good attenders, were more likely to require re-admissions for asthma. Non-attenders or poor attenders were more likely to be young (15-30 years of age), of lower socioeconomic class, of Maori or Pacific Island origin, and referred from the emergency room.⁵ Because of these high non-attendance rates at the hospital-based clinic, and a previous study from our group suggesting that asthma education would only be successful if delivered in a context appropriate to the patients' social, economic and cultural circumstances,⁶ we established an asthma education centre in the community which we hoped would meet the needs of the various ethnic and socially disadvantaged groups and which was sited close to the homes of many of the highest emergency room users. Since this represented a new strategy in health care, we attempted to determine its efficacy by way of a prospective, controlled study.

Methods

SUBJECT RECRUITMENT AND ENTRY CRITERIA

Patients attending the emergency room for treatment of acute asthma (whether hospital admission was required or not) were eligible if they (a) were diagnosed as having asthma by the attendant physician, (b) were aged between two and 55 years, (c) understood English sufficiently to answer the questionnaire, (d) lived within a defined geographical area in

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Although mortality from asthma in New Zealand continues to decline,¹ the rate remains

which emergency room attenders resided in South Auckland, (e) intended to reside in South Auckland for the ensuing nine months, and (f) could be contacted within five days of their emergency room attendance.

Written information concerning the education centre and the study proposal (in three languages) was given to the patient during their emergency room attendance and permission was obtained for one of our research assistants to make contact.

STUDY DESIGN

An initial interview was carried out shortly after attendance at the emergency room. Interviews were carried out in the hospital, patient's home or workplace, according to the patient's wish. For patients aged less than 15 years the questionnaire was administered to the principal care giver with the patient in attendance. In addition, data were extracted from hospital records.

Subjects were randomised to receive their usual care or usual care plus the services of the community education centre. Physicians were advised to manage patients as they usually would; as such, some study patients were referred to the hospital-based asthma clinic.

Nine months (\pm two weeks) later all subjects had: (a) re-administration of interviewer-based questionnaire (by the same interviewer where possible), (b) a diary of peak expiratory flow rate (PEFR) and/or symptoms maintained for one week subsequent to this second interview, (c) further review of hospital records, and (d) postal questionnaire sent to the patient's regular general practitioner (GP), with telephone follow-up.

Demographic characteristics and hospital utilisation rates were recorded also for: (1) patients fulfilling the study criteria but not recruited by the emergency room physician, and (2) patients asked by the emergency room physician but who subsequently refused or were not available either for the interview or education.

COMMUNITY HEALTH CENTRE INTERVENTION

Two nurse specialists and a group of respiratory physicians established the community edu-

cation programme which was run and administered by one nurse and three community health workers. The three community health workers came from the predominant ethnic groups in the district (Maori, Western Samoan, and Niue Islander) and were trained to deliver the education programme. Patients were evaluated as soon as was practicable after referral to the community health centre, usually in their own homes. The evaluation included an assessment of recovery from their recent asthma attack. If resolution was judged incomplete, patients were advised to attend their regular GP for assessment (those without a GP were introduced to one). Whilst GPs were informed of the study, they received no special instructions. The aim of the community health centre programme was to educate patients in (a) basic pathophysiology of asthma, (b) definition and avoidance of triggers, (c) how asthma medications work, (d) inhaler technique, (e) self-management skills (focusing on peak flow monitoring and/or symptom diaries) including the action to be taken in response to worsening asthma, and (f) how to access medical care appropriately in response to worsening asthma. Where a change in medication seemed advisable, the educators either suggested that the patient discuss this with their regular GP or, with permission, contacted the patient's GP by telephone or letter. Those without an action plan (an individualised written plan informing patients about how to manipulate medications in response to worsening asthma and how to access the medical system) were asked to obtain one from their GP.

Patients or care givers who smoked were encouraged to stop and were offered support. A summary of the asthma educator's assessment was forwarded to the patient's GP at the completion of the initial intervention. Because of the diversity of baseline knowledge and self-management skills, patients were discharged from the education programme when all topics of education were completed, rather than receiving education for a fixed period of time. The number of one to one or group interactions was noted.

An assessment of the patient's social, financial needs and cultural beliefs was made. Those requiring specific support were placed in contact with appropriate agencies or support structures within the community. Where possible, the education programme included other members of the patient's household. No charge was made for the community health centre intervention.

MEASUREMENT OF OUTCOME VARIABLES (table 1)

Asthma self-care ability was assessed using two validated scenarios adapted from Avery *et al*⁸ and Sibbald⁹ and described in detail elsewhere.¹⁰ Self-management behaviour was assessed in a role play fashion taking the child and care giver or adult (>14 years of age) through two hypothetical asthma management problems: (a) slow onset attack (SOA) - awareness of early warning signs of worsening con-

Table 1 Measurement of outcome variables

1. *Asthma severity*:
 - (a) Emergency room use, admissions, time lost from school or work, urgent visits to GP or after hours emergency medical services, and number of courses of prednisone in preceding nine months*
 - (b) PEFR obtained in morning prior to bronchodilator (7-55 year olds), one week symptom diaries⁷ (2-14 year olds)**
 - (c) Subjective evaluation of control in preceding nine months**
2. *Self-management skills*:
 - Inhaler technique,* ownership of peak expiratory flow meter, use and technique,* action plans (ownership and knowledge of plan),* assessment of asthma self-care ability using two validated scenarios¹⁰ describing a slow onset attack and severe precipitous attack*
3. *Compliance*: in relation to regular preventive medication,* peak flow meter, and asthma clinic attendance**
4. *Quality of life*: evaluation of mastery^{11*}
5. *Psychological/social*: level of anxiety/panic at time of asthma attack^{11*}
6. *Medication*: number and type of medicines*
7. *Smoking*: number of cigarettes consumed, smoking patterns in household, success in smoke cessation*
8. *Health care utilisation*: number of routine GP visits*

*Measured before intervention and nine months later.

**Measured only nine months after intervention.

Table 2 Demographic and morbidity characteristics of group not asked, group who agreed but were not recruited, and study groups (%)

	Not asked (n=233)	Agreed but not recruited (n=247)	Education group			Control group (n=249)
			All (n=251)	Education incomplete (n=61)	Education completed satisfactorily (n=190)	
Age (years)						
2-5	47	22	25	16	28	26
6-14	15	19	19	13	21	21
15-29	21	31	30	38	27	32
30-55	17	28	25	33	23	21
		***		*		
		p<0.0005				
Sex						
Male	51	49	38	43	36	46
Female	49	51	62	57	64	54
Race						
European		24	29	13	35	24
Maori		24	26	25	27	30
Pacific Islander		37	44	62	38	46
Not known	100	15		**		
Emergency room use:						
Previous 9 months						
0		73	72	62	75	72
≥1		25	28	38	25	28
Missing	100	2				
Subsequent 9 months						
0	77	69	66	59	68	71
≥1	23	31	34	41	32	29
Admissions:						
Previous 9 months						
0	90	89	90	84	92	88
≥1	10	11	10	16	8	12
Subsequent 9 months						
0	93	90	92	87	93	90
≥1	7	10	8	13	7	10

* p<0.05, ** p<0.005, *** p<0.0005.

trol, monitoring, self-prescribing ability, and judgement about when to seek medical care; and (b) severe precipitous attack (SPA) - crisis assessment and management ability. Responses to the scenarios were taped and the verbatim transcript marked by one of five scorers using a standardised and validated system. Scorers were blinded as to the intervention.

Sociodemographic characteristics (age, sex, race, social class (Elley-Irving scale¹²)) and length of time since asthma was diagnosed were used as independent variables.

DATA ANALYSIS

Fisher's exact test or Pearson's χ^2 analysis were used for univariate categorical data, logistic regression for multivariate analysis with either a binary or ordinal dependent variable, and least squares linear regression. Outcome measurements were treated as dependent variables and group (control or education group), race, age (adult (>14 years) or child), social class, sex, length of time since asthma diagnosed, age-race, age-group, and group-race interaction, and initial value of dependent variable when measured were treated as independent variables.

Indices of morbidity were analysed by combining the results of the paediatric and adult populations as these variables are not dependent on the responder. However, subjective measures were analysed separately for adults and children since the adults' answers were sought directly from the patient whereas those of the children were sought from their principal

care givers. A sample size of 250 in each group was calculated as being required to show a 30% reduction in emergency room use (based on previous studies using emergency room re-attendance rates) with a significance level of 0.05 (two-tail) and a power of 90%.

The study was approved by the Green Lane Hospital ethics committee. Patients who were assigned usual follow up care were subsequently given the opportunity to attend the education centre after the second interview nine months later. All subjects recruited gave written informed consent.

Results

Of 980 patients who fulfilled the criteria for entry into the study between January 1990 and March 1991 747 were recruited by the emergency room physician (table 2). Patients not recruited were more likely to be younger (predominantly two year olds) (p<0.001). Their admission rates for asthma in the previous nine months (and subsequently) were similar to those who agreed. Two hundred and forty seven patients who initially agreed were not subsequently interviewed; 102 declined for a variety of reasons, 56 were not contactable within five days of emergency room attendance; 45 were leaving the district, were not available for education during normal hours, or had poor command of English; 37 had had prior contact with the centre or another family member enrolled in the study; and seven for other reasons. This group was no different from the 500 study patients recruited in terms of their demographic

Table 3 Indices of severity

Index of severity	Education group		Control group		Probability of group difference
	Pre	Post	Pre	Post	
Admissions (hospital data) 9 month period	n=251	n=251	n=249	n=249	No group effect ($p=0.27$ adults, $p=0.14$ children).
0	90%	92%	88%	90%	
≥1	10%	8%	12%	10%	
Emergency room visits (hospital data) 9 month period	n=251	n=251	n=249	n=249	No group effect ($p=0.5$ adults, $p=0.6$ children). Maoris exhibited less drop in re-attendance rates.
0	72%	66%	72%	67%	
≥1	13%	19%	15%	16%	
≥2	15%	15%	12%	17%	
Acute attacks requiring GP care (patient data)	n=228	n=228	n=223	n=223	No group effect ($p=0.9$ adults, $p=0.53$ children).
0	60%	83%	57%	78%	
1	16.5%	10.5%	17%	12%	
≥2	23.5%	6.5%	26%	10%	
Days lost work or school in 9 months (patient data)	n=100	n=100	n=90	n=90	No group effect ($p=0.3$).
0	28%	42%	26%	37%	
1-5	27%	34%	34%	31%	
≥6	45%	24%	40%	32%	
Nocturnal awakening in past week (nights)		n=228		n=223	Education group ($p=0.02$) less likely to awaken with asthma, Maoris more likely ($p=0.01$)
0		71%		62%	
1-3		23		26%	
≥4		6%		12%	
How has asthma been last 9 months?		n=228		n=223	Education group ($p=0.0005$) more likely to report improvement in asthma control.
Worse		8%		16%	
Same		15%		18%	
Better		77%		66%	
PEFR diaries (age 7-55 years) PEF variability H-L/H		n=131		n=133	No group effect ($p=0.08$)
20%		44%		34%	
21-40%		35%		39%	
>40%		21%		27%	
Symptom diaries (age 2-14 years) Cough during day		n=80		n=89	Control group more likely to cough during the day ($p=0.05$).
Every/most days		14%		10%	
Some/few days		31%		52%	
Not at all		55%		38%	
Playing/running hard makes breathless		n=80		n=89	Control group more likely to find running hard makes them breathless ($p=0.05$).
Every/most days		13%		10%	
Some/few days		26%		48%	
Not at all		61%		42%	

PEFR = peak expiratory flow rate.

characteristics or emergency room admission rates in the previous (and subsequent) nine months (table 2).

The 500 patients recruited into the study form the basis of this report. There was no difference between the intervention and control groups prior to the intervention for any of the sociodemographic, clinical, or psychosocial measurements undertaken.

One hundred and ninety of the 251 patients randomised to the education centre satisfactorily completed their education (76%). However, the analysis was undertaken on an "intention to treat" basis. The median number of interactions with the community health centre was 3 (mean 3.7, range 1-10). Those who did not satisfactorily complete all education were more likely to be older than 15 years ($p<0.05$) and to be Maoris and Pacific Islanders ($p<0.005$) (table 2). Of those randomised to the education centre (251), additional help with their care was achieved as follows: in 26% telephone contact was made with the GP, in 33% a change in asthma medication was advised, and in 1% a GP was found for those without one. In 7% direct contact was made (with the patient's permission) with their school or workplace, in 9% with other

community health services or the Department of Social Welfare, in 2% with the Housing Corporation, and in 2% with a counselling service.

Two hundred and twenty eight (91%) of the education study group and 223 (90%) of the control group were available at nine months for evaluation. The sociodemographic and clinical characteristics of patients not available were not statistically different from those who were. GP questionnaires were returned by 226 of 228 (99%) of the education group and 220 of 223 (99%) of the control group. PEFR diaries were returned by 65% and 66% of the education and control groups respectively, and symptom diaries by 77% and 81% respectively.

ASTHMA SEVERITY (table 3)

There was no difference between the education and control groups for most of the indices of morbidity measured when controlled for age, socioeconomic status, sex, race, and length of time since asthma diagnosed, though control group children showed a smaller reduction in admission rate ($p<0.05$) (self reported). For all indices of morbidity the initial value - that is, morbidity in the previous nine months -

best predicted morbidity in the nine months subsequent to entry into the study. Acute attacks requiring GP care and the number missing a lot of time from work or school fell for both groups, but the difference between the intervention and control groups did not reach significance.

No demonstrable difference between the education and control groups could be defined for five of the symptoms monitored within the symptom diaries, but children in the education group were less likely to cough during the day ($p=0.05$) and were less likely to find that running hard made them breathless ($p=0.05$). The education group awoke less frequently with asthma ($p=0.02$) in the week before the second interview and were more likely to report improvement in asthma control ($p=0.0005$) in the nine months following randomisation.

SELF-MANAGEMENT SKILLS (table 4)

Whilst there was an improvement in inhaler technique within the education group ($p<0.05$), no difference could be demonstrated between the two groups. Although the educated group acquired more peak expiratory flow meters than the control group ($p<0.0001$), this was not surprising since they were distributed by the community health centre. Pacific Islanders were least likely to have a peak expiratory flow meter at entry into the study ($p<0.0001$). Inhaler technique improved more in the education group in both children ($p=$

0.02) and adults ($p<0.005$). Both groups acquired more action plans following randomisation, but this occurred more often in the children ($p=0.0001$) and adults ($p=0.0$) attending the education centre.

Knowledge regarding the appropriate steps to take in response to gradually worsening asthma improved more in the education group than the control group for both adults ($p=0.005$) and the children's principal care givers ($p>0.05$). European care givers improved more than their Pacific Island or Maori counterparts ($p=0.001$). Knowledge regarding the appropriate action to take when confronted with sudden and severe worsening of asthma also improved more in the adults in the education group ($p<0.01$) than in the control group. Again, European care givers were more likely to show an improvement in knowledge than were Pacific Islanders or Maoris ($p=0.001$).

COMPLIANCE

There was no difference in the change in compliance with prophylactic medication during the study between the two groups. Similarly there was no difference in change in attendance rates at the hospital-based asthma clinic between the two study groups. Appropriate use of the peak expiratory flow meter (daily or response to worsening symptoms) improved in patients owning a flow meter at entry into the study, but there were no between group differences.

Table 4 Self-management, knowledge, psychosocial measures

	Education group		Control group		Probability of group difference
	Pre	Post	Pre	Post	
Peak expiratory flow meters (≥ 5 years age)	n = 183	n = 183	n = 167	n = 167	Education group more likely to acquire flow meter ($p<0.0001$) and to acquire improved technique in both children ($p<0.05$) and adults ($p<0.005$).
Yes	52%	93%	56%	59%	
No	48%	7%	44%	41%	
Action plans	n = 228	n = 228	n = 223	n = 223	Children ($p<0.0001$) and adults ($p<0.01$) in education group more likely to acquire action plan.
Yes	22%	61%	18%	36%	
No	78%	39%	82%	64%	
Inhaler technique	n = 161	n = 161	n = 159	n = 159	No group effect. Adults ($p<0.1$), children ($p>0.05$).
Satisfactory	47%	64.5%	54%	54%	
Major deficiency	52%	35%	45%	44%	
Useless	1%	0.5%	1%	2%	
Preventive medicine	n = 228	n = 228	n = 223	n = 223	Children ($p<0.0005$) and adults ($p<0.05$) in education group more likely to acquire preventive medication.
Yes	41%	70%	37%	51%	
No	59%	30%	63%	49%	
Slow onset attack (max 15 points)	n = 227	n = 227	n = 221	n = 221	Improvement in knowledge for both care givers ($p>0.05$) and adults ($p<0.005$) from education group.
0-3	38%	27%	40%	40%	
4-8	58%	64%	56%	56%	
>9	4%	9%	4%	4%	
Rapid onset attack (max 7 points)	n = 227	n = 227	n = 221	n = 221	Improvement in knowledge for adults ($p<0.01$) but not care givers ($p=0.5$) from education group.
0-2	16%	16%	17%	14%	
3-4	48%	36%	52%	54%	
≥ 5	36%	48%	31%	32%	
Panic/anxiety	n = 228	n = 228	n = 223	n = 223	Education group care givers ($p<0.05$) but not adults ($p=0.25$) exhibited less panic.
Never/hardly ever	33%	56%	46%	54%	
Sometimes	38%	29%	35%	29%	
Always/nearly always	29%	15%	25%	17%	
Someone else in home able to manage asthma attack		n = 210		n = 214	Education group adults ($p<0.05$), but not care givers ($p=0.1$) more likely to have someone else in home with knowledge of how to cope with acute attack.
Yes		86%		75%	
No		14%		25%	

QUALITY OF LIFE

There was no difference between the groups with respect to the improvement in ability of patients to do the things they liked.

PSYCHOLOGICAL/SOCIAL (table 4)

Both study groups reported less panic and anxiety at the time of an asthma attack when evaluated nine months after recruitment into the study. There was a greater reduction in anxiety within the care givers in the education group ($p < 0.05$). Adults attending the education centre were more likely to have someone else in the home who knew how to manage an asthma attack than those in the control group ($p < 0.05$).

MEDICATIONS

Patients in the education group had a greater increase in use of inhaled steroids or cromolyn at completion of the study than the control group in both the adult ($p < 0.05$) and paediatric ($p < 0.01$) populations.

SMOKING

Within the education and control groups 34% and 33% respectively of adults smoked at entry into the study and a similar proportion within each group was still smoking at its completion. The pattern of smoking within the household was not influenced by the education programme.

HEALTH CARE UTILISATION

There was no significant difference between the education and control groups at the completion of the study in the frequency of routine visits to the GP (GP-derived data). European care givers visited their GP more frequently for regular care than did Maori and Pacific Island care givers ($p = 0.05$).

Discussion

Most studies evaluating asthma education have been inadequate because of problems of selection bias, non-randomisation, and insufficient follow up time to assess the efficacy of the educational programme. The only evaluated programmes developed to reach disadvantaged, low socioeconomic populations are those of Evans,¹³ Maiman,¹⁴ Lewis,¹⁵ Mayo,¹⁶ and Mitchell.¹⁷ Our study aimed at targeting a multiracial community in a disadvantaged neighbourhood with the knowledge that previous strategies, including a free hospital-based asthma clinic, appeared to be failing. This is the largest study on asthma education and has assessed outcome measurements in more detail than before. By employing a pragmatic study design the relative efficacy of education could be defined. Despite the efforts made to improve the accessibility of asthma education to the target groups, attendance at the community health centre continued to be poor for Maori and, more particularly, Pacific Island pop-

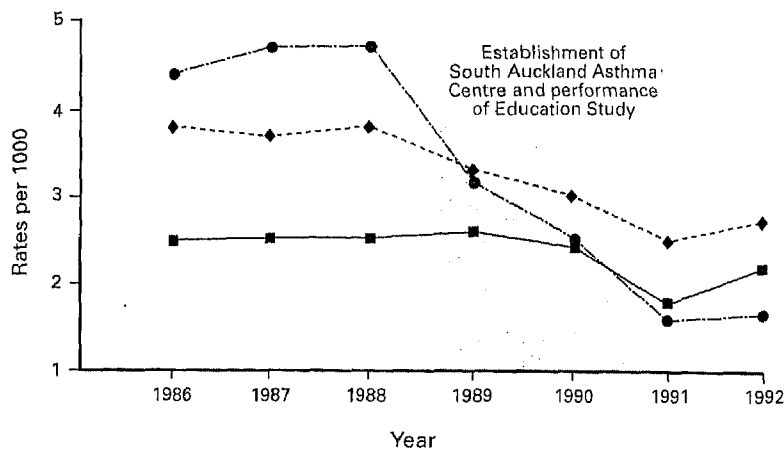
ulations. Our study analysed on an "intention to treat" basis the patients who were randomised to the education centre. After attendance, when compared with the control group, the education group had: more preventive medication usage (inhaled steroids and cromolyn), more peak expiratory flow meters and better flow meter technique, more individualised self-management plans, less nocturnal awakening and better self-reported control of asthma, better knowledge of appropriate action to take when confronted with worsening asthma, and a greater number of people in their home who could help in managing an asthma attack.

However, despite the fact that those attending the community health centre acquired both knowledge and self-management skills, there was little change in any of the indices of illness behaviour measured (compliance with medication, smoking cessation, or hospital outpatient attendance). Furthermore, there was no demonstrable difference between the education and control groups at the completion of the study in conventional measurements of asthma morbidity - namely, attendance at emergency room, hospital admissions, acute GP visits, days lost from work or school, or prednisone courses.

These findings are consistent with the findings of Bauman.¹⁸ As a result of a meta-analysis on 34 published and four unpublished education studies he concluded that asthma education programmes have significant effects (at the 0.05 level) on all categories of outcome, but that the largest effects were on asthma knowledge and self-management behaviour, rather than on hospital admissions, emergency room attendances, and urgent physician visits.

Despite improvements in knowledge and self-management skills as a result of attendance at the education centre, the impact on measurements of morbidity is small, for which there may be a number of explanations. Measurements of emergency room use and hospital admissions as outcome measures may only be of use in asthmatic subjects who have high attendance or admission rates as Clark *et al* have shown.¹⁹ Although the study sample size was calculated to show a 30% reduction in emergency room re-attendance rates within the education group, 50% of re-attendances occurred within one month and 17% within one week. Self-management skills are unlikely to have been acquired or effectively employed to prevent emergency room re-attendances within such a short time.

Peak flow or symptom diaries are difficult to obtain and are often completed inaccurately other than in homogeneous groups of well educated, middle class people with close supervision and support throughout the time of data collection. Well completed peak flow diaries were only procured in 66% in our study. Although variability in peak expiratory flow rate in the education group was not different from the control group, the low return of diaries may have influenced this result. Patients randomised to the education centre did have less nocturnal awakening in the week before their



Asthma admission rates for the study area (●—●), the rest of Auckland (■—■), and for New Zealand (◆---◆) 1986-92.

nine month evaluation and were more likely to report an improvement in control over the previous nine months. These subjective evaluations are prone to bias, however, although there was no evidence of bias in the education group's responses to other questions where replies could be validated against objective measurements – for example, hospital admissions, emergency room attendance, acute GP visits. As a result we are left with the uncertainty as to whether the education centre contributed to a change in asthma severity or not, although we acknowledge that if there was an improvement in severity it was small.

The aim of the community health centre was to teach asthma self-management skills in the hope of improving self-management behaviour – namely, regular use of preventive medication, self-monitoring of asthma severity, and earlier and more appropriate use of the health care system in response to worsening asthma. By employing community health workers of the same ethnicity as the patients we hoped to combine the various health belief models inherent within this multiracial population with a conventional western approach to asthma care. However, Maori and Pacific Islanders were the least likely to satisfactorily complete the education programme and this reflected the experience at the hospital-based asthma clinic.⁵ Maoris required more emergency room re-attendances and courses of prednisone and, along with Pacific Islanders, more time away from work in the months subsequent to referral to the community health centre than did Europeans. Together with Pacific Islanders, Maoris exhibited less improvement in their knowledge regarding self-management than did Europeans. The relatively poor attendance by Pacific Islanders and Maoris at the community health centre may have impacted on the ability of the centre to substantially improve indices of severity within the education group, and simply having educators of a similar ethnic background may have been insufficient to integrate the newly acquired information/knowledge into the Maori and Pacific Islanders' own health belief systems. There was nothing from the questionnaire submitted at the completion of the study to suggest a lack of satisfaction with the

education centre. Although 25% of patients stated that they were not taught all they wanted to know, most expressed appreciation of the help and advice received and there was no difference in response between the three racial groups.

Improvement in both self-management skills and use of preventive medication in the control group was greater than had been predicted before the study and suggests that the medical care system within South Auckland was already working reasonably well. For many, an attack of asthma severe enough to warrant emergency room attendance was a sufficient stimulus to improve upon asthma management. Baseline knowledge, self-management skills, and the proportion taking preventive medication appeared to be superior to that described in other education studies.^{13-15 20}

Since re-attendance at the emergency room was similar in those who were and were not enrolled in the study, the results could not be interpreted as indicating that, by being recruited into the study, management was improved. However, the community health centre and the study itself may have had an effect on the wider community as indicated by the significant improvement in indices of morbidity within the community targeted. Contact with the education centre by patients may have changed the practice of some GPs within the region, particularly with regard to the prescribing of a preventive medication and the use of self-management plans. There are important advantages in studying methods of medical management in a community setting, not the least of which is the improvement in quality of care which accompanies a research orientated attitude.^{21 22} Some community health centre attenders may also have educated patients in the community. Although we were careful to exclude patients who had had prior interaction with the community health centre, either directly or indirectly (15% of those who agreed but were not recruited had had contact), using a pragmatic study design we could not discount an influence of the community health centre on the control population. During the study period there was a 67% reduction in hospital admission rate from the geographical area defined for the purposes of this study (population 157 917) compared with a 22% reduction for the rest of Auckland (population 742 377) and 34% for New Zealand (population 3 343 100) (figure).

The study results suggest that only small benefits are associated with a time-limited education-based intervention. Those patients with the highest baseline self-management skills had the most experience of asthma management, which suggests that knowledge and self-management skills are accumulated with the opportunity to practise as well as learn. To be successful, therefore, education may need to be continuously available so that patients have the opportunity of gaining information and advice to improve upon their self-management skills as opportunities to learn are presented by the occurrence of more troublesome symptoms. This should include a culturally sensitive

and geographically and financially accessible service, yet we were unable to substantially improve attendance rates by Maoris and Pacific Islanders, although there was an improvement in their knowledge. The dramatic reductions in admission rates from the study area which paralleled the establishment of the community health centre, and the development and subsequent performance of the study, suggests that factors influencing admission rates are likely to be complex and multifactorial. Performing such a large community-based study may have positively influenced asthma management in the area and reduced the opportunity of showing substantial reductions in morbidity as a result of attendance at the community health centre. New Zealand has noted important reductions in both morbidity and mortality from asthma over the past three years¹ and these trends have paralleled a change in emphasis of management, namely, increased use of higher dose inhaled steroids, reduction in the use of inhaled sympathomimetics, and continued emphasis on acquisition of self-management skills.²³ Nowhere in New Zealand has the reduction in asthma admissions been so dramatic as in South Auckland where the opportunity to reinforce this message directly within the community by way of this study has occurred. The apparent impact of this study and of the community health centre on the wider community therefore does give hope of success to those health care professionals incorporating programmes which utilise these management strategies, though acknowledging that greater success may have been achieved by: (1) integrating the education process more fully with usual health care, (2) providing the opportunity for patients to update knowledge and skills over time, and (3) developing the programme to help further overcome the health belief differences between Pacific Island, Maori, and European communities.

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