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Changes in drug utilisation and asthma management practices among purchasers of anti-asthma drugs from community pharmacies in the Illawarra between 1991 and 1995

Timothy Owen

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**CHANGES IN DRUG UTILISATION AND ASTHMA MANAGEMENT PRACTICES
AMONG PURCHASERS OF ANTI-ASTHMA DRUGS FROM COMMUNITY
PHARMACIES IN THE ILLAWARRA BETWEEN 1991 AND 1995**

A report submitted in fulfilment of GHMD997,
Major Project for the award of the degree of

MASTER OF PUBLIC HEALTH
UNIVERSITY OF WOLLONGONG

by
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EXECUTIVE SUMMARY

In 1991 the Illawarra Pharmacists Association in conjunction with the Illawarra Public Health Unit and the University of Wollongong Department of Mathematics undertook the Pharmacy Exit Survey. This was a cross-sectional survey administered to purchasers of anti-asthma medications throughout community pharmacies in the Illawarra. This survey was repeated in 1995 allowing evaluation of improvements in adult asthma between 1991 and 1995 possibly due to local and national initiatives.

Indicators of asthma management are described in terms of the National Asthma Campaign recommendations. These parameters are compared between those obtaining their β -agonists primarily over the counter and those who obtain them primarily by prescription, as well as analysing changes between the 1991 and 1995 samples. Potential confounders such as age, sex and severity indicators were controlled for using the stepwise logistic regression procedure. Crude prevalence estimates of asthma management factors were weighted using data from a second study utilising routinely collected drug prescription information, in an attempt to adjust for the potential bias from an oversampling of those who purchased their medications more frequently.

Of the respondents 35.4 per cent reported primarily obtaining β -agonist inhalers over the counter. The prescription group had more severe asthma than the 'over the counter' group. The 'over the counter' group was less likely to wheeze at least once per week ($P=0.005$, $OR=0.59$, $CI=0.39-0.96$), to have had at least five attacks of asthma or wheeze in the last year ($P=0.001$, $OR=0.54$, $CI=0.35-0.80$), to have been admitted to hospital within the last 12 months ($P=0.002$, $OR=0.31$, $CI=0.16-0.62$), and to use a β -agonist inhaler at least daily ($P=0.004$, $OR=0.64$, $CI=0.42-0.99$).

Even after taking into account differences in disease severity, the 'over the counter' group was less likely to have objective airways measurement by the doctor usually or always ($P=0.007$, $OR=0.37$, $CI=0.21-0.67$), to have a written action plan ($P=0.008$, $OR=0.48$, $CI=0.26-0.88$) and to have regular medical review at least once per year ($P=0.001$, $OR=0.50$, $CI=0.27-0.93$). The 'over the counter group' was also less likely to use preventative medication ($P=0.001$, $OR=0.29$, $CI=0.16-0.51$) or ipratropium bromide ($P=0.001$, $OR=0.27$, $CI=0.09-0.88$) regularly during the previous six months, and less likely to use inhaled corticosteroids ($P=0.004$, $OR=0.35$, $CI=0.21-0.61$), and ipratropium bromide ($P=0.001$, $OR=0.44$, $CI=0.20-0.94$) at any time.

Between 1991 and 1995 there was no significant improvement in non-drug related asthma management indicators. Prescribing patterns improved with increases in the regular use of inhaled corticosteroids or sodium cromoglycate ($P=0.001$, $OR=0.87$, $CI=0.80-0.95$) and an increase in the use at any time of sodium cromoglycate ($P=0.033$, $OR=0.87$, $CI=0.80-0.95$). The use of medications which may be inappropriate for asthma (eg. antibiotics), are still prevalent however there has been a reduction in the use of theophylline both regularly ($P=0.001$, $OR=1.27$, $CI=1.14-1.41$) and at any time ($P=0.001$, $OR=1.27$, $CI=1.15-1.40$). These improvements in prescribing are in line with the recommendations of the Asthma Management Plan.

Improvements in asthma management however are sub-optimal, particularly in relation to the 'over the counter' group. Targetted local initiatives are needed to improve adult asthma management in the Illawarra region, supporting programs from the National Asthma Campaign and any state-wide initiatives.

1. INTRODUCTION

There has been a number of local programs in the Illawarra which were aimed at improving asthma management. The first of these involved 94 per cent of community pharmacies in a regional research program which aimed to identify barriers to asthma management and problems implementing the "Pharmacists Asthma Management Plan". Several interested pharmacists then participated in focus groups to further examine the issue, and were finally brought together with a group of Illawarra general practitioners to examine common problems.¹

The National Asthma Campaign began in 1990, with the first phase concentrating on health professionals: doctors, pharmacists, nurses and ambulance officers.² The National Asthma Campaign produced and mailed 28 000 detailed educational booklets to general practitioners across Australia, together with information pamphlets for patients and cards to aid doctors in producing individualised action plans for their patients. The National Asthma Campaign also took out more than 30 two page advertisements in the most frequently read medical journals promoting the Asthma Management Plan, the use of peak flow meters and preventative medications.³

The second phase of the campaign was directed at the asthma sufferer and aimed to increase knowledge about asthma and health lifestyle. This phase consisted of an education program run through schools, unions and employer groups and distribution of the Asthma Management Plan through health care providers.⁴

The third phase in mid 1991 was a major asthma awareness media campaign directed at the general public. It aimed to inform the general community of the limitations of using inhaled bronchodilator medication to treat asthma. This phase of the campaign was based around a 30 second television public service announcement. This depicted a colourless male robotic figure who repetitively overuses bronchodilator medication until he hears a new message about asthma management. He acquires an asthma action plan and becomes more human. The final message states that people should

turn to their health professional to learn prevention, leading to a symptom free life.⁵

Few studies have examined asthma management in the Australian community. These surveys give some indication of the effect of both local and national initiatives in asthma management. They provide the basis for objective measurement of application by health professionals and acceptance by consumers of National Asthma Campaign guidelines. The baseline measurement in 1991 showed areas of sub-optimal asthma management and the analysis of both the 1991 and 1995 data will give an assessment of changes in practice over this time frame.

2. BACKGROUND

Asthma is defined as a chronic inflammatory condition of the airways characterised by bronchial mucosal inflammation, with oedema, infiltration with inflammatory cells (especially eosinophils), hypertrophy of glands and smooth muscle and damaged epithelium. Symptoms include wheezing, coughing, chest tightness and shortness of breath. This condition may lead to irreversible obstruction of air flow in some chronic patients.^{6,7,8}

Asthma is a significant problem in Australia both in terms of mortality and morbidity as well as cost to the Australian community.^{9,10} In 1991 the total cost burden of asthma in Australia was estimated to be between \$585 and \$720 million. This comprised of \$320 million of direct medical costs and between \$260 and \$400 million indirect costs. Indirect costs are those due to lost productivity to society due to asthma. It includes the costs of invalidity, absenteeism, reduced effectiveness whilst at work, and work time lost from attending appointments. The direct medical costs are made up of general practitioner time, medication, specialist time, emergency attendances, hospital outpatient and inpatient services.¹¹ Asthma is also one of the most common causes of admission to hospital. Asthma is a high priority on the health agenda because it is a largely manageable disease. Well managed sufferers can usually lead perfectly normal lives.

The 1989-90 National Health Survey run by the Australian Bureau of Statistics estimated that 1.4 million or between 8-9 per cent of all Australian are clinically diagnosed asthmatics.¹² This finding was supported by a National Asthma Campaign baseline survey which estimated prevalence in adults aged 12 and over to be 7 per cent.¹³ Bauman *et al* in a survey of a stratified random sample of schoolchildren and their parents from schools in Sydney, Melbourne, Brisbane and the Upper Hunter Valley (New South Wales) found 19 per cent of adults reporting wheeze symptoms in the previous 12 months and 7.2 per cent had diagnosed asthma.¹⁴ A repeat of this survey in 1993, found no significant change in reported wheezing or in diagnosis of

asthma in adults.¹⁵

The National Asthma Campaign was initiated in 1989 with the aim of improving asthma management through promotion of a recognised Asthma Management Plan which was devised by the Thoracic Society of Australia and New Zealand.¹⁶ The latest revision of the Asthma Management Plan was published in 1993 by the National Asthma Campaign.¹⁷ This approach is widely recommended however it has not been unequivocally shown to lead to improved asthma control.¹⁸

The Asthma Management Plan is made up of six clear steps which can be followed by clinicians. It draws on evidence that many asthma deaths are associated with under treatment related to an over-reliance on bronchodilators and under use of inhaled and oral corticosteroids, failure to make objective measurement of disease severity and inadequate supervision.^{19,20,21,22,23} Regular use of inhaled corticosteroids is emphasised in the Asthma Management Plan, even for those patients of moderate disease severity. Inhaled corticosteroids are extremely important as they act directly on the airways to reduce inflammation and bronchial hyper responsiveness. β -agonists on the other hand can only alleviate the symptoms of asthma and do nothing to alter the underlying disease process.²⁴ Sears *et al* found in a double blinded, placebo-controlled, randomised crossover study that regular inhalation of β -agonist drugs was associated with a deterioration of asthma control in the majority of subjects compared with β -agonist use for symptom relief only.²⁵

Written action plans are also a very important component of the Asthma Management Plan as an inability to recognise deteriorating asthma has been suggested as an important preventable factor in asthma deaths.^{26,27,28} Asthma self management plans are essential in the long term management of adult asthmatics because they help people to recognise deteriorating asthma and initiate early and appropriate treatment.²⁹ Charlton *et al* have challenged the need for a peak flow meter in order to implement self management plans. They tested through a randomised follow-up trial two self management plans, the first measuring peak expiratory flow and the second based

purely on symptoms. Both self management plans produced significant reductions in the measured outcomes, however there were no significant differences between the groups using the different plans. It was concluded that the peak flow meter was not the crucial ingredient in the decreasing morbidity of the two groups of asthmatics and that teaching patients the importance of their symptoms and the appropriate action to take when their asthma deteriorates is the key to effective management of asthma.³⁰

Step 1 of the Asthma Management Plan involves assessing the overall severity of the disease. Step 2 deals with achieving the best possible lung function. Step 3 involves maintaining that best possible lung function through home monitoring of peak expiratory flow, drug therapy and avoidance of trigger and aggravating factors. Step 4 is concerned with developing an action plan including recognising indicators of worsening asthma, developing the written crisis plan and knowing how best to seek medical help. This action plan should be reviewed after attacks. Step 5 deals with educating, supporting and counselling the patient and family, and step 6 encourages regular review of the patient.

Because of the very high prevalence of asthma, the condition is often managed in the primary health care setting by general practitioners^{31,32,33}, and by pharmacists. Tse *et al* in 1991 found that most general practitioners around Australia knew and reported practicing appropriate asthma management, however room for improvement was found in regards to the understanding and use of theophyllines, the use of preventative medications such as inhaled steroids and sodium cromoglycate, the use of crisis planning for severe attacks and lung function measurement.³⁴ Fardy and Jeffs in the Illawarra found asthma knowledge of general practitioners to be very high, with 88 per cent of general practitioners scoring more than 86 per cent on a test.³⁵ The results of a “subsample” of Illawarra general practitioners from a national general practitioner survey³⁶ showed reported management practices were generally of a high standard, however they were not entirely consistent with the Asthma Management Plan. Illawarra general practitioners were no different to those of the national sample. The results suggested that Illawarra general practitioners were inappropriately prescribing

theophyllines and that inhaled steroids and sodium cromoglycate were being underused as preventative medications. Only 40 per cent of Illawarra general practitioners were developing written crisis plans for patients and only 36 per cent reported measuring airways function at most visits.³⁷ Beilby *et al* found no significant differences in methods of treatment of adults with asthma between city and country general practitioners.³⁸

The National Asthma Campaign was effective in making general practitioners aware of the principles of good asthma management. As mentioned earlier, the first stage of the campaign basically consisted of a mail out package to general practitioners of information and aids to good management as well as a series of advertisements in medical journals promoting the principles of the Asthma Management Plan. After the campaign general practitioners reported significant improvements in airway function measurement practices, the use of preventative drug therapy and the use of written action plans.³⁹ A population based approach has also been taken in evaluating the National Asthma Campaign. After the campaign there was an increase in the use of inhaled corticosteroids and a decrease in the use of theophyllines. Measurement of lung function by a doctor in the previous year, ownership of a peak flow meter, and possession of a written action plan all increased.⁴⁰ All of these changes are in line with the Asthma Management Plan.⁴¹

It has also been suggested that the Asthma Management Plan may not be appropriate or feasible for general practitioners as it was written by specialist respiratory physicians, and there are differences between the spectrum of patients and severity of diseases encountered by specialists and general practitioners^{42,43}. Kelly *et al* in a study of community pharmacists in the Illawarra found that pharmacists also had problems implementing the "Pharmacists Asthma Management Plan". Aspects of the plan which pharmacists had most difficulty implementing were ensuring people with asthma had a written action plan, identifying undiagnosed asthmatics, ensuring people with asthma know why and how a peak flow meter is used, and advising on identification and avoidance of trigger factors. Barriers were identified to improved asthma management.

These included a lack of time, a lack of remuneration for counselling, and a customer attitude of reluctance to discuss their condition and a primary lack of awareness of the need for preventative medication. Aspects of the plan pharmacists had least difficulty implementing included ensuring an understanding of the difference between 'reliever' and 'preventer' medication, ensuring correct inhaler technique, identifying and referring frequent users of β -agonists, and emphasising and assisting with compliance.⁴⁴

In 1975 salbutamol, terbutaline and feneterol were moved from schedule 4 (prescription only) to schedule 3 (available from a pharmacist without a prescription) in NSW with other states doing the same through to 1983. The benefits of such a move included a financial gain for the community because of a reduction in asthmatics consulting a doctor just for a script as well as making these reliever medications easily accessible to the community. Potential risks included: an increase in unsupervised use of β -agonist aerosols; reduced access to education about asthma; delays in seeking essential treatment for worsening asthma, and a development of excessive dependence on them limiting the use of other drugs which can only be obtained with a prescription.⁴⁵ Jenkins *et al* in a study of data of prescribed antiasthmatic drugs reported that non-prescription sales of salbutamol inhalers increased 410 per cent from 1980-6.⁴⁶

An important issue in the current management of asthma is the potential problems associated with overuse of β -agonists. Sears *et al* compared the control of asthma during two regimes of feneterol use. In most cases, control of asthma was less effective with regular use of high doses of feneterol than with use as dictated by necessity.⁴⁷ Haahtela *et al* found that antiinflammatory therapy with inhaled budesonide (inhaled corticosteroid) to be an effective first-line treatment for patients with newly detected, mild asthma. It was found to be superior to the use of terbutaline (β -agonist) in such patients.⁴⁸

Henry *et al* compared asthmatics aged 13-55 years in the Hunter Valley region of New South Wales who either used purchase as their sole means of acquiring metered dose

inhalers and used no prescription medication, or who used a prescription to obtain some or all of their asthma drugs. Of all salbutamol inhalers dispensed, 40 per cent were purchased over the counter. They found 97.5 per cent of the purchase group were undertreated, in that they required either inhaled or oral steroids and 47 per cent of the prescription group received inadequate treatment. They also found that the purchase group “seldom” visits the doctor (general practitioners or specialists). They concluded that the present scheduling of β -agonists continues to legitimise the unsupervised use of bronchodilator aerosols as a sole treatment by significant numbers of asthmatics in Australia.⁴⁹

Marks *et al* in a study of asthmatics in Lismore, New South Wales in 1994, found that many participants with moderate or severe asthma were not managed in accordance with the recommendations of the asthma management plan. In particular small proportions took inhaled steroids, used a peak flow meter or had a written action plan. Excess use of β -agonists were not however found to be a significant problem⁵⁰

Westley-Wise *et al* (1991) found in a review of pharmacy databases in the Illawarra, that of those prescribed an average of more than 6 inhalations of β -agonists daily, 19 per cent were not prescribed any preventative medications and 36 per cent were prescribed an average of less than 2 inhalations of preventative medication daily.⁵¹ This represented relatively poor drug therapy in the overall management of asthmatics in the area. They estimated that at least 40 per cent of asthmatics were receiving inadequate doses of inhaled preventative medications.

A study of 434 adult β -agonist purchasers in the Illawarra in 1991 found that 39 per cent purchased their β -agonist medications primarily over the counter.⁵² The over the counter group was younger, and less likely to report regular peak flow measurement by the doctor. The group mostly obtaining their β -agonists medicators by prescription was more likely to have regular routine medical review, and more likely to use inhaled preventative medication regularly. They also found significant use of medications which may be contraindicated for people with asthma, including the use of

theophyllines without the use of inhaled corticosteroids which the Asthma Management Plan⁵³ specifically advises against.

3. RESEARCH QUESTIONS

The aim of the Pharmacy Exit Survey is to identify current asthma management practices in terms of utilisation of:

- preventative medication and β -agonists,
- medications which may be contraindicated for people with asthma,
- peak flow meters for self-monitoring and monitoring by doctors,
- written management plans, and
- routine medical review.

It is also aimed to compare indicators of disease severity and appropriateness of asthma management practices between those who predominantly obtained their β -agonist inhalers over the counter (the OTC group) and those who obtained them mainly by prescription (the prescription group).

The aim of the Drug Utilisation Survey is to provide information related to the prescribed medication obtained by users of anti-asthma medications in the Illawarra including:

- preventative medications and β -agonists, and
- medications which may be contraindicated for people with asthma.

For the purpose of this study, the Drug Utilisation Survey aims to provide information of the frequency of visits to community pharmacies to have prescriptions filled for β -agonists and the frequency of visits for all anti-asthma medications. These measures are used to weight prevalence estimates of asthma management factors to adjust for the potential over sampling of those who more regularly obtain anti-asthma medications from community pharmacies.

These surveys were first carried out in 1991 by the Illawarra Pharmacists Association in conjunction with the Illawarra Area Health Service Public Health Unit and the University of Wollongong Department of Mathematics. The results of these surveys are reported elsewhere.^{54,55}

These surveys were repeated in 1995. The aim is to analyse changes in asthma management practices between 1991 and 1995 which may be due to local or national initiatives which occurred during this period.

4. METHODS

A literature search was carried out using MEDLINE database from years 1990 to 1996 and CINAHL (Nursing and Allied Health) databases from years 1982 to 1996. Key search terms included asthma, management, adult and Australia. References from the results of the original search were used to extend searches. Literature was also obtained from area health service reports and local publications.

The same methodology was used in 1995 as in 1991, except for slight changes to the questionnaire, and minor differences in the methods of analysis from the original study.⁵⁶ Reported here are the results of identical analysis of both 1991 and 1995 Pharmacy Exit Survey data, except in relation to question 13 which was added in 1995. All pharmacies (66) in the Illawarra area were asked to participate. Each pharmacist was asked to recruit 12 consecutive clients aged 15 years or over obtaining any anti-asthmatic medications (β -agonists, theophyllines, inhaled corticosteroids, ipratropium, or sodium cromoglycate) to fill in the one page questionnaire. Each pharmacist completed a data sheet including: the gender and age (estimated for non-responders); their answers to two questions derived from a previously validated questionnaire⁵⁷ (concerned with previous asthma diagnosis and chronic sputum production); and whether they agreed or refused to complete the questionnaire. The questions concerned with sputum production and asthma diagnosis were used to exclude people with chronic bronchitis (defined as reporting chronic sputum production and never been diagnosed with asthma) at the data analysis stage.

The 1991 and 1995 participant information sheets and questionnaires are shown in appendices 2 and 3 respectively. The questionnaires include questions related to asthma management practices such as use of peak flow meters, written plans, medication, and medical supervision. Also included are questions related to asthma severity such as frequency of wheezing and "attacks" of asthma and wheeze, previous hospitalisation, and frequency of use of β -agonist inhalers. In addition there was one question about the frequency of visits to community pharmacies to obtain anti-asthma

medications. The questionnaire was altered slightly from 1991 to 1995. Changes were made in Question 1 and Question 11 due to changes in the availability of brand name drugs, as well as other minor changes in question expression. Slight wording changes can also be noted in Question 3 and Question 7. These wording changes were unintentional, however they are not expected to influence the responses in any manner. Question 13, which related specifically to the frequency of visiting community pharmacies to have scripts filled for β -agonists, was also added to the questionnaire in 1995. Question 12, which is primarily used for weighting the asthma management prevalence estimates, obtains the frequency of pharmacy visits to obtain medication "for your chest". The corresponding information from the Drug Utilisation Survey measures the frequency of visits to community pharmacies to have prescriptions filled for either all anti-asthma medications or for β -agonist medications. Question 13 therefore is a more specific question which collects information which is more appropriate for the weighting methodology used.

The data were entered into EpiInfo v5.1. The data were analysed using SAS v6.10 for Windows. Prevalence estimates were made of indicators related to asthma severity and asthma management. Crude odds ratios are used to compare severity and asthma management indicators between groups who reported mainly obtaining β -agonists over the counter or mainly by prescription in 1995 and between the 1991 and 1995 groups. Statistical significance was established by means of the Chi-squared test. Confidence limits of the crude odds ratios were calculated by the methods of Cornfield using EpiInfo v6.0.⁵⁸

The crude odds ratios for potential measures of disease severity were adjusted for age and sex by logistic regression analysis. The crude odds ratios for asthma management indicators were adjusted for potential confounders such as age, sex and severity using stepwise logistic regression analysis. Indicators of disease severity controlled for in the analysis were frequency of wheezing (categorised as at least weekly, at least most days, and at least daily), frequency of asthma attacks (categorised as at least five and at least 10 in the last year), frequency of pharmacy visits to obtain "chest" medication

(categorised as at least once in the last 12 months, at least 3-4 times, at least 5-10 times, at least 11-25 times and more than 25 times), previous hospitalisation (characterised as ever and within the last year), and frequency of inhaler use (characterised as at least once a week, a few times per week, once a day, five times a day, and more than ten times a day). The logistic regression analyses were also run without including frequency of inhaler use as an indicator of disease severity. Statistical significance are shown at the 0.05 level with 95 per cent confidence limits.

In order to adjust prevalence estimates for the potential bias from an oversampling of those who purchase their asthma medications more frequently, crude weighting factors were devised based on the reported frequency of pharmacy visits. Estimates were made of the proportions of the population visiting pharmacies on various numbers of occasions in the previous year based upon the patient profile developed in a Drug Utilisation Survey. A sample of Illawarra pharmacists was asked to produce a patient profile for the previous 12 months of a systematic sample of 15 clients who obtained β -agonist medication by prescription on at least one occasion. Data were obtained for 284 patients and included the names, doses, quantities and dates of all medications obtained on prescription. Only partial information on age was obtained. Two different weighting factors were devised. The first was based on self reported frequency of pharmacy visits to obtain anti-asthma medication and the second on frequency of pharmacy visits to have prescriptions filled for β -agonist drugs. The weighting factors were calculated by dividing the population distribution by the sample distributions. These weighting systems were used for both the group mainly obtaining their β -agonist inhalers over the counter and those mainly using a prescription. Due to only 35 per cent of Drug Utilisation Survey patient profiles containing information on age, some are likely to be for those aged less than 15 years. The Pharmacy Exit Survey was only for those aged 15 years and over.

The following classifications were used for anti-asthma drugs in this study. This classification is presented in full in the Pharmacists Asthma Management Handbook.⁵⁹ The first group of drugs are reliever medications (brand names for the drugs are shown

in italics). The primary reliever drugs used are β -agonists which come in both short-acting [eg. salbutamol (*Asmol, Respolin, Ventolin*); terbutaline (*Bricanyl*); fenoterol hydrobromide (*Berotec*)] and long-acting [eg. salmeterol (*Serevent*)] forms. The second group of reliever drugs are theophyllines [eg. *Austyn, Elixophyllin, Nuclin, Slo-Bid, Theo-Dur*] which are now considered to have limited importance in the treatment of asthma. The final reliever drug is ipratropium bromide [*Atrovent*] which is an anti-cholinergic bronchodilator.

The second classification of drugs are preventive medications. Sodium cromoglycate [*Intal*] is the first of this drug classification. Sodium cromoglycate inhibits the release of mediators of the allergic reaction from sensitised cells, preventing both the immediate and late asthmatic responses to stimuli. The second preventive medicator is Nedocromil sodium [*Tilade*] which is mainly used in adults and children over 12 years of age. The third group of drugs in this classification are Inhaled Corticosteroids [eg. beclomethasone [*Aldecin, Becloforte, Becotide*]; budesonide [*Pulmicort*]; fluticasone [*flixotide*]. This group of drugs is the main preventive therapy for adults. Nebulised Corticosteroids are also available eg. budesonide [*Pulmicort*] however their use is limited. The final group of preventive medications are oral corticosteroids eg. prednisolone and prednisone which are considered the most effective emergency medication for an acute asthma attack not responding to β -agonist.

5. RESULTS

5.1 1995 Pharmacy Exit Survey

Six hundred and eighty three purchasers of anti-asthma medications aged 15 years and over were asked to fill in the one page written questionnaire. Of these 507 agreed giving a response rate of 74.2 per cent. Eighteen respondents reported chronic sputum production (at least 3 months continually) without being diagnosed with asthma and were excluded from further analysis. A comparison between respondents and non-respondents of the written questionnaire is presented in Table 1.

The median age of the respondents was 40 years with 47.9 per cent being male compared with 36 years and 53.8 per cent respectively for non-respondents. Ninety per cent of respondents reported having been diagnosed with asthma by a doctor compared with 86 per cent of non-respondents. Forty three per cent of respondents and 40.5 per cent of non-respondents reported chronic sputum production. The proportion of non-respondents obtaining their β -agonist inhalers over the counter on this occasion was 55.6 per cent compared with 40.2 per cent of respondents. Of the respondents 20.5 per cent reported that they always, and a further 14.9 per cent reported that they usually obtained their β -agonist medications over the counter, while 51.1 per cent indicated that they always and 13.5 per cent usually used a prescription to obtain their β -agonist medication.

The respondents were more likely to have had their asthma diagnosed by a doctor (OR = 2.09, P = 0.022) and less likely to have obtained their anti-asthma medication over the counter on this occasion (OR = 0.54, P = 0.00082). There was no significant difference (using t-test) between the respondents and non-respondents in age (P = 0.055), the proportion of males (OR = 0.79, P = 0.186), nor the proportion who reported chronic cough and sputum (OR = 0.93, P = 0.741).

Table 1: Comparison of questionnaire respondents and non-respondents

	Respondents	Non-respondents	Odds Ratio (95% CI)	P value
age (years)*	43.6 (40) n = 491	42.6 (36) n = 174	-	0.055
sex (M)	47.9% n = 472	53.8% n = 173	0.79 (0.55-1.14)	0.186
asthma diagnosis by doctor	93.6% n = 390	87.5% n = 144	2.09 (1.05-4.13)	0.022
chronic cough and sputum	43.0% n = 335	40.5% n = 123	0.93 (0.60-1.44)	0.741
obtained medication 'over-the-counter'	40.2% n = 378	55.6% n = 171	0.54 (0.37-0.79)	0.00082

* Mean ages reported with median ages in parentheses. Difference tested using a t-test.

Respondents were classified as either mainly obtaining their anti-asthmatic medications over the counter or by prescription based upon their self reported frequency of using a doctors prescription to obtain β -agonist inhalers. Of the respondents 35.4 per cent reported never (20.5 per cent) or mostly not (14.9 per cent) using a prescription to obtain inhalers. These respondents were classified as mainly obtaining inhalers over the counter. Of the respondents 64.6 per cent reported mostly (13.5 per cent) or always (51.1 per cent) using a prescription to obtain inhalers and were hence categorised as mainly obtaining their inhalers by prescription.

A comparison of those respondents predominantly obtaining their β -agonist inhalers over the counter and those using a prescription is shown in Table 2. The median age of the OTC group was 31 years compared with 50 years for the prescription group. The age difference was highly significant ($P = 0.001$). The OTC group (56.6 per cent) was

more predominantly male (OR = 1.74, P = 0.004) than the prescription group (42.8 per cent). Of the prescription group, 48.1 per cent reported chronic cough and sputum compared with 32.5 per cent of the OTC group. There was no difference found in the proportion having asthma diagnosed by the doctor (OR = 0.98, P = 0.956).

Table 2: Comparison of 'OTC group' and 'Prescription group'

	OTC group	Prescription group	Odds ratio (95% CI)	P value
age (years)*	34.0 (31) n = 171	48.5 (50) n = 312	-	0.001
sex (M)	56.6% n = 168	42.8% n = 297	1.74 (1.17-2.60)	0.004
asthma diagnosis by doctor	93.7% n = 142	93.8% n = 242	0.98 (0.39-2.49)	0.956
chronic cough and sputum	32.5% n = 120	48.1% n = 210	0.52 (0.32-0.85)	0.006

* Mean ages reported with median ages in parentheses. Difference tested using a t-test.

Table 3 shows indicators of disease severity compared between the OTC group and the prescription group.

Of the respondents 69.6 per cent reported at least daily use of their β -agonist inhalers and 18.1 per cent at least five times daily use, 60.6 per cent reported wheezing at least most days and 28.5 per cent every day, 51.0 per cent reported at least five attacks within the previous twelve months and 36.5 per cent reported at least ten attacks. Of the respondents 55.0 per cent had been admitted to hospital with 'asthma' or 'wheeze' at least once previously and 13.7 per cent were admitted within the previous year.

Table 3: Potential measures of disease severity compared between the 'OTC group' and the 'Prescription group'

	OTC group	Prescription group	Crude odds ratio (95% CI)	Adjusted odds ratio (95% CI)	P value
wheeze at least once per week	69.5% n = 167	80.9% n = 303	0.54 (0.34-0.85)	0.59 (0.39-0.96)	0.0320
wheeze most or every day	49.1% n = 167	67.0% n = 303	0.48 (0.32-0.71)	0.55 (0.36-0.84)	0.0052
wheeze every day	20.4% n = 167	33.0% n = 303	0.52 (0.32-0.83)	0.66 (0.40-1.07)	0.0945
at least 5 attacks in the last year	39.2% n = 171	57.6% n = 309	0.47 (0.32-0.71)	0.54 (0.35-0.80)	0.0039
at least 10 attacks last year	25.7% n = 171	42.4% n = 309	0.47 (0.31-0.72)	0.51 (0.33-0.80)	0.0035
hospital admission ever for asthma or wheeze	54.8% n = 168	55.1% n = 305	0.99 (0.66-1.47)	0.79 (0.52-1.20)	0.2746
hospital admission within the last 12 months	7.14% n = 168	17.4% n = 305	0.37 (0.18-0.73)	0.31 (0.16-0.62)	0.0009
use of beta-agonist puffer at least daily	61.4% n = 175	74.1% n = 309	0.56 (0.37-0.85)	0.64 (0.42-0.99)	0.0451
use of beta-agonist puffer at least 5 times daily	15.2% n = 168	19.7% n = 305	0.73 (0.43-1.24)	0.79 (0.46-1.38)	0.4122
more than 25 visits to pharmacy for medication	8.24% n = 170	20.9% n = 307	0.34 (0.18-0.65)	0.42 (0.21-0.82)	0.0112

These potential measures of disease severity were compared between the two groups. In the crude analysis and after adjusting for age and sex the OTC group was less likely to report wheezing at least once per week (OR = 0.59; 95% CI = 0.39-0.96; P = 0.0320) as well as at least most days (OR = 0.55; 95% CI = 0.36-0.84; P = 0.0052). In the

crude analysis, the OTC group was less likely to report wheezing every day (OR = 0.52, P = 0.004) however after adjusting for differences in age and sex, this difference was not significant (OR = 0.66, 95% CI = 0.40-1.07; P = 0.0945).

The prescription group was more likely to have had at least 5 attacks in the last year (OR = 0.54, 95% CI = 0.35-0.80, P = 0.0039) and to have had at least 10 attacks last year (OR = 0.51, 95% CI = 0.33-0.80, P = 0.0035). The prescription group was also more likely to have been admitted to hospital within the last 12 months for asthma or wheeze (OR = 0.31, 95% CI = 0.16-0.62, P = 0.0009), to use their β -agonist puffer at least daily (OR = 0.64, 95% CI = 0.42-0.99, P = 0.0451), and to make more than 25 visits to the pharmacy in the last 12 months to obtain medication (OR = 0.42, 95% CI = 0.21-0.82, P = 0.0112). There were no significant differences found in the proportion of people who had ever been admitted to hospital for asthma or wheeze (OR = 0.79, P = 0.2746) or in those reporting use of β -agonist puffers at least 5 times daily (OR = 0.79 P = 0.4122).

Table 4 shows weighted and crude prevalence estimates of factors related to the management of adult asthma compared between the OTC group and the prescription group. The weighted estimates are based upon self reported frequency of pharmacy visits to obtain anti-asthma medication. The table is also shown in appendix 5 with weighted estimates based upon frequency of pharmacy visits to have prescriptions filled for β -agonist drugs. Minimal changes were noted in the prevalence estimates of the management factors as a result of this methodology.

Table 4: Weighted (and crude) prevalence estimates of factors related to the management of adult asthma compared between the 'OTC group' and the 'Prescription group'

	Total population	OTC group	Prescription group	Crude odds ratio (95% CI)	Adjusted odds ratio (95% CI)	P value
objective airways measurement by the doctor 'usually' or 'always'	27.9% (31.1%)	25.4% (23.4%) n = 171	32.2% (35.4%) n = 308	0.56 (0.36-0.87)	0.37 (0.21-0.67)	0.0011
peak flow readings at home	28.1% (31.0%)	26.2% (25.7%) n = 171	27.8% (34.0%) n = 306	0.69 (0.45-1.08)	0.67 (0.38-1.17)	0.1597
instruction in inhaler technique	92.8% (93.4%)	92.8% (91.8%) n = 171	93.3% (94.2%) n = 311	0.69 (0.32-1.51)	0.87 (0.37-2.01)	0.7407
written action plan	24.7% (27.8%)	20.5% (20.5%) n = 171	27.6% (31.8%) n = 311	0.55 (0.35-0.88)	0.48 (0.26-0.88)	0.0184
regular medical review at least once per year	53.7% (60.2%)	45.3% (42.2%) n = 135	60.7% (70.3%) n = 239	0.31 (0.19-0.49)	0.50 (0.27-0.93)	0.0297
regular medical review at least twice per year	40.3% (48.4%)	33.6% (27.4%) n = 135	47.9% (60.3%) n = 239	0.25 (0.15-0.40)	0.32 (0.17-0.64)	0.0009

As recommended management depends on disease severity, the crude estimates of the difference between the OTC and prescription groups were adjusted for the potential measures of disease severity along with age and sex.

Of the total population, 27.0 per cent (21.7 per cent of the OTC group and 29.8 per cent of the prescription group) did their own peak flow readings at home. Of the respondents 24.9 per cent (18.9 per cent of the OTC group and 28.7 per cent of the prescription group) had a written action plan. Of the respondents 53.9 per cent (43.2 per cent of the OTC group and 61.1 per cent of the prescription group) reported having regular medical review at least once per year. Of the respondents 39.7 per cent (25.2 per cent of the OTC group and 48.4 per cent of the prescription group) had regular

medical review at least twice per year. After adjusting for potential measures of disease severity, age, and sex, there were significant differences between the OTC group and the prescription group in regards to; objective airways measurement by the doctor 'usually' or 'always' (OR = 0.37; 95% CI = 0.21-0.67; P = 0.0011), possession of a written action plan (OR = 0.48; 95% CI = 0.26-0.88; P = 0.0184), regular medical review at least once per year (OR = 0.50; 95% CI = 0.27-0.93; P = 0.0297), and regular medical review at least twice per year (OR = 0.32; 95% CI = 0.17-0.64; P = 0.0009).

The proportion of adult asthmatics who use various medications regularly ('most of the time') are presented in Table 5, with the use of medications at any time (those indicating taking medications 'most of the time' and 'in bad attacks') in the previous six months presented in Table 6. Again the weighted estimates are based upon the frequency of pharmacy visits to obtain anti-asthma medication. The results of using frequency of pharmacy visits to have prescriptions filled for β -agonist drugs as the basis for the weighting factors are presented in appendix 5. Again only minor differences were noted between the two weighted estimates.

Table 5: Weighted (and crude) prevalence estimates of the use medications regularly during the previous six months compared between the 'OTC group' and the 'Prescription group'

	Total population n = 483	OTC group n = 171	Prescription group n = 312	Crude odds ratio	Adjusted odds ratio (95% CI)	P value
inhaled corticosteroids or cromoglycate	55.0 (61.9%)	43.4% (50.3%)	61.6% (68.3%)	0.47 (0.31-0.70)	0.29 (0.16-0.51)	0.0001
inhaled corticosteroids	48.8% (54.2%)	37.9% (44.4%)	53.9% (59.6%)	0.54 (0.37-0.80)	0.35 (0.20-0.60)	0.0001
cromoglycate	13.4% (16.4%)	10.8% (11.7%)	14.6% (18.9%)	0.57 (0.32-1.01)	0.67 (0.32-1.37)	0.2679
ipratropium	10.7% (17.6%)	4.40% (5.26%)	14.5% (24.4%)	0.17 (0.08-0.37)	0.27 (0.09-0.88)	0.0289
theophylline	9.58% (12.8%)	5.07% (7.02%)	11.7% (16.0%)	0.40 (0.19-0.79)	0.30 (0.11-0.79)	0.0151
oral corticosteroids	5.81% (8.70%)	5.30% (5.85%)	6.20% (10.3%)	0.54 (0.24-1.19)	1.45 (0.50-4.21)	0.4974
antibiotics	15.3% (15.9%)	9.73% (11.1%)	18.2% (18.6%)	0.55 (0.24-0.88)	0.83 (0.41-1.70)	0.6118

It is estimated that 55.0 per cent of adult asthmatics (43.4 per cent of the OTC group and 61.6 per cent of the prescription group) regularly used inhaled preventative medications (corticosteroids or sodium cromoglycate), and 35.1 per cent have used antibiotics and 15.3 per cent have used antihistamines 'for chest problems' within the previous six months.

After adjusting for age, sex, and indicators of disease severity the OTC group is less likely to regularly use inhaled preventative medications (OR = 0.29; 95% CI = 0.16-0.51; P = 0.0001), inhaled corticosteroids (OR = 0.35; 95% CI = 0.20-0.60; P = 0.0001), ipratropium (OR = 0.27; 95% CI = 0.09-0.88; P = 0.0289) and theophylline (OR = 0.30; 95% CI = 0.11-0.79; P = 0.0151). The OTC group is less likely to have used inhaled corticosteroids (OR = 0.35; 95% CI = 0.21-0.61; P = 0.0002), ipratropium (OR = 0.44; 95% CI = 0.20-0.94; P = 0.0480) and theophylline (OR = 0.43; 95% CI = 0.20-0.94, P = 0.0348) for chest problems at any time within the previous six months.

Table 6: Weighted (and crude) prevalence estimates of use of medications at any time during the previous six months compared between the 'OTC group' and the 'Prescription group'

	Total population n = 477	OTC group n = 171	Prescription group n = 306	Crude odds ratio (95% CI)	Adjusted odds ratio (95% CI)	P value
inhaled corticosteroids	55.4% (60.0%)	47.0 (51.5%)	60.1% (64.7%)	0.58 (0.39- 0.86)	0.35 (0.21- 0.61)	0.0002
cromoglycate	15.7% (18.4%)	15.0% (15.8%)	15.7% (19.9%)	0.76 (0.45- 1.28)	0.85 (0.43- 1.66)	0.6260
ipratropium	15.5% (23.0%)	10.4% (11.1%)	18.4% (29.5%)	0.30 (0.17- 0.53)	0.44 (0.20- 0.94)	0.0480
theophylline	13.5% (18.6%)	7.79% (11.1%)	16.6% (29.5%)	0.42 (0.24- 0.75)	0.43 (0.20- 0.94)	0.0348
oral corticosteroids	18.4% (24.2%)	16.8% (19.9%)	19.3% (26.6%)	0.68 (0.42- 1.10)	1.00 (0.52- 1.94)	0.9916
antihistamines	15.3% (16.8%)	16.1% (18.7%)	15.4% (15.7%)	1.24 (0.73- 2.07)	2.76 (1.38- 5.52)	0.0042
antibiotics	35.1% (38.9%)	31.2% (32.8%)	37.2% (42.3%)	0.66 (0.44- 1.00)	1.12 (0.66- 1.88)	0.6791

Due to slight changes in methods of data analysis for the 1995 sample to those previously reported⁶⁰, the results of an identical analysis of the 1991 data are reported in appendix 4.

5.2 Changes between 1991 and 1995

A comparison between 1991 and 1995 respondents is shown in Table 7 below. There were no statistically significant differences found between the 1991 and 1995 groups of respondents in regards to age, sex, asthma diagnosis by doctor, and chronic cough and sputum. The median age for both 1991 and 1995 respondents was 40 years. The proportion of those respondents who were male decreased between 1991 and 1995 (53.3 per cent in 1991 to 47.9 per cent in 1995) however this difference was not statistically significant (OR = 1.24, P = 0.105). The number of respondents that reported having their asthma diagnosed by a doctor decreased slightly (95.4 per cent in 1991 to 93.5 per cent in 1995) as did the proportion reporting chronic cough and sputum (46.2 per cent in 1991 to 43.0 per cent in 1995) however neither change was statistically significant.

Table 7: Comparison of 1991 and 1995 respondents

	1991	1995	Odds ratio (95% CI)	P value
age (years)*	42.1 (40) n = 419	43.4 (40) n = 478	-	0.055
sex (M)	53.3%	47.9%	1.24 (0.95-1.63)	0.105
asthma diagnosis by doctor	95.4%	93.6%	1.41 (0.70-2.87)	0.303
chronic cough and sputum	46.2%	43.0%	1.14 (0.80-1.61)	0.443

* Mean ages reported with median ages in parentheses. Difference tested using a t-test.

There has been a slight but insignificant increase in the proportion of respondents using a prescription to obtain β -agonist inhalers from 61.2 per cent in 1991 to 64.6 per cent in 1995 (OR = 1.16, P = 0.243). The self reported frequency of use of a prescription to obtain β -agonist inhalers is shown in Table 8.

Table 8: Self reported frequency of prescription use to obtain β -agonist inhalers compared between 1991 and 1995 respondents.

Use of Prescription	1991	1995
	n = 423	n = 483
Never	23.9%	20.5%
Mostly Not	14.9%	14.9%
"Over the counter group"	38.8%	35.4%
Mostly	13.2%	13.5%
Always	48.0%	51.1%
"Prescription group"	61.2%	64.6%

Potential measures of disease severity compared between 1991 and 1995 are shown in table 9. Slight reductions from 1991 to 1995 were found in the proportion reporting; wheeze at least once per week, wheeze most or every day, wheeze every day, at least five attacks of asthma or wheezing last year, at least 10 attacks of asthma or wheezing last year, hospital admission for asthma or wheezing within the last 12 months and the use of β -agonist puffers at least daily. In the crude analysis however, none of these potential disease severity measures had changed significantly. After adjusting for age and sex, the reduction in the use of β -agonist puffers at least daily from 75.3 per cent in 1991 to 69.6 per cent in 1995 was of marginal significance (OR = 1.08; 95% CI = 1.00-1.16; P = 0.0500).

Table 9: Potential measures of disease severity compared between 1991 and 1995 respondents

	1991	1995	Crude odds ratio (95% CI)	Adjusted odds ratio (95% CI)	P value
wheeze at least once per week	78.5% n = 405	76.7% n = 477	1.11 (0.80-1.54)	1.04 (0.96-1.13)	0.3618
wheeze most or every day	63.5% n = 405	60.8% n = 477	1.12 (0.84-1.49)	1.04 (0.97-1.11)	0.3038
wheeze every day	29.6% n = 405	28.9% n = 477	1.03 (0.77-1.40)	1.02 (0.95-1.10)	0.5365
at least 5 attacks in the last year	54.0% n = 422	51.2% n = 488	1.12 (0.85-1.47)	1.04 (0.97-1.11)	0.2427
at least 10 attacks in the last year	39.8% n = 422	36.5% n = 488	1.15 (0.87-1.52)	1.04 (0.97-1.11)	0.2556
hospital admission ever for asthma or wheeze	50.5% n = 424	54.7% n = 481	0.84 (0.64-1.11)	0.95 (0.89-1.01)	0.1202
hospital admission within the last 12 months	14.9% n = 424	14.1% n = 481	1.06 (0.72-1.56)	1.01 (0.91-1.10)	0.9247
use of beta-agonist puffer at least once a week	93.8% n = 417	90.7% n = 426	1.53 (0.90-2.61)	1.12 (0.98-1.27)	0.0861
use of beta-agonist puffer at least a few times a week	92.1% n = 417	86.0% n = 486	1.89 (1.20-3.00)	1.18 (1.06-1.32)	0.0032
use of beta-agonist puffer at least daily	75.3% n = 417	69.6% n = 486	1.33 (0.98-1.81)	1.08 (1.00-1.16)	0.0500
use of beta-agonist puffer at least 5 times daily	15.4% n = 417	18.3% n = 486	0.81 (0.56-1.17)	0.95 (0.87-1.04)	0.2632
use of beta-agonist puffer more than 10 times a day	3.84% n = 471	3.29% n = 486	1.17 (0.55-2.50)	1.04 (0.87-1.25)	0.6814

Various management factors were compared between 1991 and 1995 as shown in Table 10 below. Weighted estimates are based on self reported frequency of pharmacy visits to obtain anti-asthma medications. The prevalence of reporting; peak flow readings at home increased from 19.5 per cent in 1991 to 27.0 per cent in 1995 (OR = 0.71, P = 0.022) and the prevalence of reporting regular medical review at least once per year also increased, from 46.5 per cent in 1991 to 53.9 per cent in 1995 (OR = 0.71, P = 0.024). After adjusting for potential measures of disease severity, age and sex, the differences were not statistically significant for both peak flow readings at home (OR = 0.94; 95% CI = 0.86-1.03; P = 0.2060) and regular medical review at least once per year (OR = 0.92; 95% CI = 0.83-1.02; P = 0.1127) or for any of the other non-medication related management factors.

Table 10: Weighted (and crude) prevalence estimates of factors related to the management of adult asthma compared between the 1991 and 1995 respondents

	1991	1995	Crude odds ratio (95% CI)	Adjusted odds ratio (95% CI)	P value
objective airways measurements by the doctor 'usually' or 'always'	24.1% (28.2%) n = 422	28.4% (31.4%) n = 487	0.86 (0.64-1.15)	0.96 (0.88-1.05)	0.4036
peak flow readings at home	19.5% (24.5%) n = 421	27.0% (31.3%) n = 485	0.71 (0.52-0.96)	0.94 (0.86-1.03)	0.2060
instruction in inhaler technique	89.6% (91.9%) n = 421	90.9% (93.1%) n = 490	0.85 (0.50-1.43)	1.02 (0.88-1.18)	0.7658
written action plan	18.4% (22.8%) n = 417	24.9% (27.6%) n = 490	0.78 (0.57-1.06)	0.97 (0.89-1.07)	0.5807
regular medical review at least once per year	46.5% (51.6%) n = 314	53.9% (60.2%) n = 379	0.71 (0.52-0.97)	0.92 (0.83-1.02)	0.1127
regular medical review at least twice per year	36.2% (43.3%) n = 314	39.7% (48.6%) n = 379	0.81 (0.59-1.11)	0.94 (0.84-1.04)	0.2119

A comparison between 1991 and 1995 of the regular use of various medications is shown in Table 11, with use at any time shown in Table 12. Again weighted estimates are based on frequency of pharmacy visits for anti-asthma medications. The proportion of respondents using inhaled corticosteroids increased from 39.3 per cent in 1991 to 48.0 per cent in 1995 (OR = 0.90, 95% CI = 0.83-0.98, P = 0.016) and use of sodium cromoglycate has increased from 9.12 per cent to 13.4 per cent in 1995 (OR = 0.82, 95% CI = 0.73-0.93, P = 0.0015). The proportion of respondents reporting use of theophyllines decreased from 19.0 per cent in 1991 to 9.58 per cent in 1995 (OR = 1.27, 95% CI = 1.14-1.41, P = 0.0001).

Table 11: Weighted (and crude) prevalence estimates of the use of medications regularly during the previous six months compared between 1991 and 1995 respondents

	1991 n = 421	1995 n = 491	Crude odds ratio (95% CI)	Adjusted odds ratio (95% CI)	P value
inhaled corticosteroids or cromoglycate	43.7% (51.1%)	55.0% (62.1%)	0.64 (0.48-0.83)	0.87 (0.80-0.95)	0.0019
inhaled corticosteroids	39.3% (46.4%)	48.0% (54.4%)	0.73 (0.55-0.95)	0.90 (0.83-0.98)	0.0160
cromoglycate	9.12% (10.5%)	13.4% (16.7%)	0.58 (0.39-0.88)	0.82 (0.73-0.93)	0.0015
ipratropium	9.14% (14.0%)	10.7% (17.5%)	0.77 (0.53-1.11)	0.91 (0.81-1.03)	0.1542
theophylline	19.0% (24.2%)	9.58% (13.0%)	2.13 (1.49-3.05)	1.27 (1.14-1.41)	0.0001
oral corticosteroids	6.00% (8.39%)	5.81% (8.76%)	0.95 (0.59-1.55)	0.98 (0.86-1.13)	0.7894
antibiotics	16.0% (15.2%)	15.3% (16.3%)	0.92 (0.63-1.33)	1.01 (0.91-1.13)	0.8277

No significant changes were found in the regular use or the use at any time of ipratropium, oral corticosteroids, antihistamines and antibiotics in the previous six months.

Table 12: Weighted (and crude) prevalence estimates of the use of medications at any time (regularly and/or during bad attacks) compared between 1991 and 1995 respondents

	1991 n = 421	1995 n = 491	Crude odds ratio (95% CI)	Adjusted odds ratio (95% CI)	P value
inhaled corticosteroids	47.0% (54.6%)	55.4% (60.1%)	0.80 (0.61-1.05)	0.94 (0.86-1.02)	0.1392
cromoglycate	11.2% (13.5%)	13.5% (18.7%)	0.68 (0.47-0.98)	0.87 (0.77-0.97)	0.0117
ipratropium	13.9% (20.3%)	15.5% (23.0%)	0.85 (0.61-1.18)	0.95 (0.86-1.06)	0.3901
theophylline	25.8% (32.6%)	13.5% (18.7%)	2.10 (1.53-2.88)	1.27 (1.15-1.40)	0.0001
oral corticosteroids	15.4% (21.7%)	18.4% (24.2%)	0.87 (0.63-1.19)	0.99 (0.90-1.09)	0.8559
antihistamines	12.9% (13.5%)	15.3% (16.7%)	0.78 (0.53-1.14)	0.93 (0.83-1.04)	0.2012
antibiotics	35.0% (36.8%)	35.1% (39.1%)	0.91 (0.69-1.20)	0.99 (0.91-1.07)	0.7975

6. STUDY LIMITATIONS

The repeated cross-sectional study design is limited in that there are no control areas to determine whether local or national initiatives have had any affect. The study cannot be generalised to an area outside of the Illawarra region of New South Wales.

Although there was an attempt to exclude those with chronic bronchitis in the Pharmacy Exit Survey, there may still be some in the study population of both the Drug Utilisation Survey and the Pharmacy Exit Survey. The criteria which was used to exclude people with chronic bronchitis should keep the numbers small. It is possible that those people with very mild asthma would not make it into the sample due to their infrequent need to visit a pharmacy. Some mild asthmatics may not actually be using drug therapy and hence not visit a pharmacy at all.

Although prevalence estimates of management indicators were weighted in an attempt to adjust for the fact that more severe asthmatics would visit community pharmacies more frequently, it is possible that disease severity has still not been adequately adjusted for.

Although pharmacists were specifically requested to approach consecutive clients in the Pharmacy Exit Survey, there was no means of assuring this. It is possible that pharmacists may not have actually recorded all non-responders which would increase the response rate. Where there was more than one pharmacist working at a particular pharmacy, it is not known whether consecutive clients were approached by just one pharmacist or by all pharmacists at the pharmacy. This may be relevant where certain pharmacists may work set shifts which may service customers with different characteristics. It is also not known whether just pharmacists or pharmacy assistants were involved in administering the survey.

Although a reliability check was made on the questionnaire in 1991, the questionnaire has not been validated, except for the initial questions relating to asthma diagnosis and

chronic cough and sputum which were recorded on the pharmacists data sheet.

None of the measures of disease severity used in the Pharmacy Exit Survey were objective and all were self-reported. The measurement of whether respondents have asthma, although previously validated is still a subjective measure.

Although most questions from the Pharmacy Exit Survey questionnaire had a very high rate of completeness, the question relating to respondents visiting the doctor about their chest were not answered by as many respondents as the rest of the questionnaire. The questionnaire was also affected by some minor wording changes in 1995. These changes are not expected to significantly alter the respondents interpretation of those questions affected.

The Drug Utilisation Survey also possibly suffers selection bias due to the non-random selection of pharmacies to be involved in the study. The work involved in providing the information from the pharmacy databases is extensive and very time consuming and hence only those pharmacists who were interested in asthma were asked to participate.

Another issue in the Drug Utilisation Survey is the extent of passing trade which was received by pharmacies. In 1995, the participating pharmacies were considered to be affected little by passing trade. The smaller the amount of passing trade, the higher the quality of information relating to asthma sufferers prescribed medication use.

There are a number of deficiencies with the methodology used to control for the likely oversampling of more severe asthmatics visiting community pharmacies more frequently to obtain anti-asthma medications. Firstly the data collected in the Drug Utilisation Survey is limited to prescribed anti-asthma medications and does not include those customers purchasing beta-agonist inhalers over the counter. The corresponding question in the Pharmacy Exit Survey which was used both in 1991 and 1995 refers to pharmacy visits to obtain medication for the chest. In 1995 the more appropriate question 13 was added to the Pharmacy Exit Survey which referred specifically to

pharmacy visits to have prescriptions filled for beta-agonist drugs. In order to compare between 1991 and 1995, the first less appropriate question had to be used to weight the prevalence estimates of management factors. Nevertheless, as discussed in the results, it is reassuring that the estimate did not differ appreciably depending on which question was used to derive the weighting factor for the 1995 data.

Secondly, the data able to be obtained on age from the Drug Utilisation Survey was limited and hence some of those aged less than 15 years are included in the sample. In the Pharmacy Exit Survey, pharmacists were instructed to only administer the questionnaire to customers who were 15 years of age and over. Some aged less than 15 years were surveyed, however more complete data on age allowed their exclusion from the sample. Therefore the two sample populations differ in that the Pharmacy Exit Survey includes those purchasing beta-agonist inhalers over the counter whereas the Drug Utilisation Survey only includes data on prescriptions, and the Drug Utilisation Survey possibly includes some individuals aged less than 15 years.

Because only people obtaining their medication by prescription were sampled in the Drug Utilisation Survey, mild asthmatics would have been under-represented in these data. This is another reason why it is likely that the prevalence estimate of management factors have not adequately adjusted for the over-representation of more severe asthmatics.

7. DISCUSSION

The group predominantly obtaining their β -agonists over the counter is younger, more likely to be male, and less likely to report chronic cough and sputum. Males are less likely to go to the doctor than females⁶¹, and hence less likely to obtain a script. There are quite large financial benefits from obtaining various anti-asthma medications on prescription rather than over the counter for those people holding a concession card. β -agonists can be obtained for around a quarter of the price if a script and concession card is used. Holders of concession cards are generally older and hence use a script in order to obtain the financial benefits. Older people are also more likely to visit a general practitioner for problems other than asthma and may obtain scripts for anti-asthma medications on the same visit.

Although there has only been a statistically insignificant increase in the proportion of respondents mainly obtaining their β -agonists by prescription, it is similar to the increase noted in a similar study in the Hunter Valley region of NSW in 1989.⁶² It is unlikely that there would be an increase in the proportion using a prescription to obtain β -agonist inhalers without an increase in the proportion of people having routine medical review.

In 1991, the only difference in potential disease severity indicators between the OTC group and the prescription group were in hospital admissions for asthma or wheeze. In 1995 the differences between the OTC group and the prescription group were more prominent with regards to disease severity with the prescription group more likely to wheeze at least once per week, wheeze most or every day, have at least 5 attacks of asthma or wheeze in the last year, have at least 10 attacks of asthma or wheeze in the last year, to be admitted to hospital within the last 12 months for asthma or wheeze and to use a β -agonist inhaler at least daily. These differences were evident both in the crude analysis and after adjusting for age and sex. This suggests that the gap between the OTC group and the prescription group with regards to disease severity may be widening. More severe cases of asthma are more likely to be prescribed preventative

drugs which are only available by prescription and obtain their β -agonists prescriptions at the same time.

As in 1991, in 1995 the OTC group was significantly less likely, both in crude and adjusted analysis, to have objective airways measurement by the doctor 'usually' or 'always' (OR = 0.37; 95% CI = 0.21-0.667; P = 0.0011), regular medical review at least once per year (OR = 0.50; 95% CI = 0.27-0.93; P = 0.0297) and regular medical review at least twice per year (OR = 0.32; 95% CI = 0.17-0.64; P = 0.0009). In 1995 there was an additional difference between the OTC group and the prescription group in that the prescription group were more likely to have a written action plan of what to do in an attack (OR = 0.48; 95% CI = 0.26-0.88; P = 0.0184). This difference may also be related to improved management by general practitioners. The National Asthma Strategy Goals and Targets set by the National Asthma Campaign aimed for 21 per cent of people to have a written action plan by the year 2000. The baseline for this target is 14 per cent of adults with a written action plan.⁶³ A repeat of this survey in 1993 found the proportion of people with a written action plan to be 19.9 per cent.⁶⁴ Therefore it can be seen that the Illawarra in 1995 had a reasonably good proportion of adults with written action plans (24.9 per cent) and the magnitude of the improvement since 1991 was similar to the National Asthma Campaign survey completed slightly earlier. The National Asthma Campaign sampling method was very different from that of the Illawarra survey. The National Asthma Campaign survey sampled parents of a random sample of primary schoolchildren from Sydney, Melbourne, Brisbane and the Upper Hunter Valley (New South Wales). It is also possible that the weighting method used here in the Illawarra sample does not adequately adjust for the oversampling of people with more severe asthma.

The proportion of the respondents reporting objective airways measurement by the doctor 'usually' or 'always' (28.4 per cent) and measurement of peak flow at home (27.0 per cent) were still low in 1995. The National Asthma Campaign survey reported that in 1993, 29.9 per cent of adult asthmatics had a peak flow meter and 44.4 per cent had their lung function measured by the doctor in the previous year.

There has been considerable debate recently as to whether frequency of β -agonist medication use is an indication of disease severity or of management. Logistic regression analysis was run without including frequency of β -agonist use as a potential confounder in analyses related to asthma management. The results are presented in appendix 6. Minimal changes were observed in the odds ratio estimates for the management indicators, and therefore the use of β -agonists is not considered to be a significant confounder of asthma management here.

In 1991 there was a significant difference between the OTC group and the prescription group in the reported regular use of oral corticosteroids, however in 1995, this difference was not evident. The opposite is the case with the use of theophylline which showed no significant difference between the OTC group and the prescription group in 1991, however in 1995 the difference is significant at the 0.05 level (OR = 0.30; 95% CI = 0.11-0.79; P = 0.0151). This difference was also noted in the use of theophylline at any time (OR = 0.43; 95% CI = 0.20-0.94; P = 0.0348). This is a positive result as the Asthma Management Plan recommends close supervision of the use of theophylline.⁶⁵ Overall, regular theophylline use decreased from 19.0 per cent to 9.6 per cent. This reduction in the use of theophyllines is not as great as that seen in the second evaluation survey done for the National Asthma Campaign. They report a significant reduction in theophylline use from 20.5 per cent in 1990 to 3.9 per cent in 1993.⁶⁶ Again it is possible that the weighting method used in the Illawarra survey has not adequately adjusted for an oversampling of people with more severe disease. Differences were found in regular use of inhaled corticosteroids and ipratropium between the 'over the counter' group and the prescription group both in 1991 and 1995.

While there were slight improvements in most indicators of disease severity between 1991 and 1995, these changes were not significant except in relation to the frequency of use of β -agonist inhalers. Reductions in the proportion of people using β -agonist inhalers between at least a few times a week and at least daily suggest improved disease severity and/or asthma management. Changes in prescribing which have been made are in accordance with the Asthma Management Plan with increased

prescribing of inhaled corticosteroids and a reduction in the reliance on regular use of β -agonist inhalers. These changes have occurred in those people who have a moderate (between a few times a week and four times a day) usage of β -agonist inhalers rather than those with a very high (more than 5 times a day) usage of β -agonist inhalers.

While most non-medication related management indicators improved slightly between 1991 and 1995, these changes were not significant. This is possibly due to a lack of statistical power and/or that the emphasis of the asthma management plan and local initiatives has been on better prescribing. The proportion of people having regular medical review even when their chest is not causing problems is probably higher than previously thought. Westley-Wise *et al* reported 38.1 per cent of those responding to the 1991 pharmacy exit survey having regular medical review at least once per year, and 32.1 per cent at least twice per year.⁶⁷ The corresponding proportions for the reanalysis of the 1991 pharmacy exit survey were 51.6 per cent and 43.3 per cent which are significantly higher. The initial analysis by Westley-Wise *et al* assumed non-respondents to this question did not have regular medical review. Results of the 1991 reanalysis are presented in full in appendix 4.

There has undoubtedly been an improvement in the prescribing of anti-asthma drugs in the Illawarra between 1991 and 1995. Significant improvements in the regular use of either inhaled corticosteroids or cromoglycate and a dramatic decrease in use of theophylline indicates changes in prescribing in line with the recommendations of the asthma management plan. The changes in preventative maintenance therapy have not been as great as those put forward in the National Asthma Campaign goals and targets document. The target is for 80 per cent of the adult asthmatic population to use preventative maintenance therapy by 1996, based upon a baseline measure of 39 per cent in 1990.⁶⁸ The National Asthma Campaign survey reported 38 per cent using inhaled corticosteroids or sodium cromoglycate in 1990. This increased to 43 per cent by 1993.⁶⁹ The increase in the Illawarra from 44 per cent in 1991 to 55 per cent in 1995 suggests a higher baseline and a greater increase in the Illawarra, however this may

reflect the different surveillance methods used for the national and Illawarra estimates. This increase was significant after adjusting for age, sex and potential measures of disease severity (OR = 0.87; 95% CI = 0.80-0.95; P = 0.0019).

8. CONCLUSIONS AND RECOMMENDATIONS

Prescribing changes are evident through increases in the proportion of respondents who are using preventative medications and a decrease in the use of theophyllines. These changes are in line with those recommended by the asthma management plan.

Changes in non-drug related asthma management factors were minor. This is possibly due to the emphasis which has been placed on improved drug management, or the failure of non-drug asthma management education to reach the target audience. There is some suggestion that asthma severity may have improved slightly between 1991 and 1995 which may be associated with an increase in use of preventative medications and a slight decline in frequent β -agonist use.

The increased distinction in disease severity and asthma management indicators between the OTC group and the prescription group emphasises the importance of regular medical consultation and supervised asthma management. The problem of asthma sufferers not having regular medical review should be adequately addressed through the recent introduction of the asthma card throughout the Illawarra. The asthma card aims to monitor unsupervised β -agonist use and encourages users to have routine medical review of asthma.

A coherent strategy involving as many Illawarra general practitioners and pharmacists as possible is recommended. Improved asthma management should be promoted with an emphasis on non-pharmacological issues such as the use of written action plans, peak expiratory flow measurement, and regular medical review. Previous local initiatives have only involved a small sample of interested Illawarra general practitioners. A concentrated local program with the above aims is needed to complement the strategies of the National Asthma Campaign.

The usefulness of the Pharmacy Exit Survey and the Drug Utilisation Survey is shown in this study and in order to evaluate the introduction of the asthma card in the Illawarra and other strategies presently being prepared, these surveys should again be repeated in 1999. The use of pharmacies for sample recruitment has produced excellent results and should continue to be used to monitor adult asthma management in the Illawarra.

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APPENDIX 1

Contents:

A1.1 Article

**TRENDS IN ADULT ASTHMA MANAGEMENT AND DRUG UTILISATION IN THE
ILLAWARRA AREA OF NEW SOUTH WALES**

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ABSTRACT

Objective: To describe recent trends in adult asthma management and to compare between groups primarily obtaining β -agonist inhalers 'over the counter' (the OTC group) and by prescription (the prescription group).

Setting: Consecutive clients of community pharmacies in the Illawarra purchasing anti-asthmatic medications.

Design: Repeated cross-sectional surveys of adults (aged 15 years and over) in 1991 and 1995. Data from a second study of drug prescriptions dispensed by community pharmacies were used to determine prevalence estimates of various asthma management indicators for a population of adults with asthma.

Results: β -agonist inhalers were primarily obtained over the counter by 35.4 per cent of respondents. The prescription group reported more severe disease than the OTC group. After taking into account differences between the two groups in disease severity, age and sex the OTC group was less likely to use either inhaled corticosteroids or sodium cromoglycate (OR=0.29, CI=0.16-0.51), or ipratropium bromide (OR=0.27, CI=0.09-0.88) regularly during the previous six months, and less likely to have used inhaled corticosteroids (OR=0.15, CI=0.21-0.61), and ipratropium bromide (OR=0.44, CI=0.20-0.94) at any time. The OTC group was also less likely to have routine medical review at least once per year (OR=0.50, CI=0.27-0.97), have their airways objectively measured by the doctor usually or always (OR=0.37, CI=0.21-0.67) and to have a written action plan (OR=0.48, CI=0.26-0.88). No significant improvement in non-drug related asthma management indicators between 1991 and 1995 was evident. However, prescribing patterns improved with increases in the regular use of

inhaled corticosteroids or sodium cromoglycate and a reduction in the use of theophylline. It is estimated that 55.0 per cent of adults with asthma now use inhaled preventative medications regularly, 24.9 per cent have written action plans, and 53.7 per cent have routine medical review at least once per year.

Conclusions: Improvements in asthma management are sub-optimal, particularly for people who primarily obtain their β -agonist inhalers over the counter. The recent introduction of the 'Asthma Card' in the Illawarra should address some of these issues.

INTRODUCTION

The National Asthma Campaign (NAC) began in 1989 with the aim of improving the management of asthma through the promotion of a recognised 'Asthma Management Plan'.¹ The Asthma Management Plan draws on evidence that many asthma deaths are associated with undertreatment related to an over-reliance on bronchodilator medication and underuse of inhaled and oral corticosteroids, failure to make objective measurement of disease severity and inadequate supervision.^{2,3,4,5,6} Up to two thirds of all asthma deaths may be associated with preventable factors⁷ and with currently available medication, morbidity from asthma can be reduced.⁸ The first phase of the NAC was aimed at health professionals, and included mail-outs and advertisements in frequently read medical journals promoting the asthma management plan.⁹ The second and third phases of the campaign promoted increased awareness to the asthma sufferer and the general community respectively.¹⁰

In 1991 the Illawarra Pharmacists Association in conjunction with the Illawarra Area Health Service and the University of Wollongong Department of Mathematics undertook the a survey of adult asthma management among people obtaining their medication from community pharmacies in the Illawarra. This survey was repeated in 1995 allowing evaluation of improvement in adult asthma management over this time period, as a result of both national and local initiatives.

Respondents predominantly obtaining their medications by prescription in the 1991 Pharmacy Exit Survey were managed better than those primarily purchasing their β -agonist inhalers over the counter, however the management of both groups was sub-

optimal.¹¹ Reported here are current levels of asthma management described in terms of the National Asthma Campaign recommendations. Those management indicators are compared between those predominantly obtaining their β -agonist inhalers by prescription and those primarily purchasing them over the counter as well as analysing changes between 1991 and 1995. Crude prevalence estimates of asthma management factors were weighted using data from another study of asthma drug prescriptions in an attempt to adjust for the potential bias from an oversampling of those who purchase their medications more frequently.

METHODS

The same survey methodology was used in 1995 as in 1991, except for slight changes to the questionnaire, and small differences in the methods of analysis from the original study.¹² All pharmacies (66) in the Illawarra area were asked to participate in both 1991 and 1995. Each pharmacist was asked to recruit 12 consecutive clients aged 15 years or over obtaining any anti-asthmatic medications (β -agonists, theophyllines, inhaled corticosteroids, ipratropium, or sodium cromoglycate) to fill in the one page questionnaire. Each pharmacist completed a data sheet including: the gender and age (estimated for non-responders); their answers to two questions derived from a previously validated questionnaire¹³ (concerned with previous asthma diagnosis and chronic sputum production); and whether they agreed or refused to complete the questionnaire. The questions concerned with sputum production and asthma diagnosis were used to exclude people with chronic bronchitis (defined as reporting chronic sputum production and never been diagnosed with asthma) at the data analysis stage.

The questionnaires include questions related to asthma management practices such as use of peak flow meters, written plans, medication, and medical supervision. Also included were questions related to asthma severity such as frequency of wheezing and "attacks" of asthma and wheeze, previous hospitalisation, and frequency β -agonist inhaler use. In addition two questions concerned the frequency of visits to community pharmacies to obtain anti-asthma medications and to have scripts filled for β -agonists.

The data were entered into EpiInfo v5.1 and analysed using SAS v6.10 for Windows. Prevalence estimates were made of indicators related to asthma severity and asthma

management. Crude odds ratios were used to compare severity and asthma management indicators between groups who reported mainly obtaining β -agonists over the counter or mainly by prescription in 1995 and between the 1991 and 1995 groups. Statistical significance was established by means of the chisquared test. Confidence limits of the crude odds ratios were calculated by the methods of Cornfield using EpiInfo v6.0.

The crude odds ratios for potential measures of disease severity were adjusted for age and sex by logistic regression analysis. The crude odds ratios for asthma management factors were adjusted for age, sex and indicators of disease severity using stepwise logistic regression analysis. Indicators of disease severity were frequency of wheezing (categorised as at least weekly, at least most days, and at least daily), frequency of asthma attacks (categorised as at least five and at least 10 in the last year), frequency of pharmacy visits to obtain "chest" medication (categorised as at least once in the last 12 months, at least 3-4 times, at least 5-10 times, at least 11-25 times and more than 25 times), previous hospitalisation (characterised as ever and within the last year), and frequency of inhaler use (characterised as at least once a week, a few times per week, once a day, five times a day, and more than ten times a day). The logistic regression analysis were also run without including frequency of inhaler use as a potential confounder, however the results were essentially unchanged. Statistical significance will be shown at the 0.05 level with 95 per cent confidence limits.

In order to adjust prevalence estimates of asthma management factors for the potential bias from an oversampling of those who purchase their asthma medications more frequently, crude weighting factors were devised based on the reported frequency of

pharmacy visits. Estimates were made of the proportions of the asthmatic population visiting pharmacies on various numbers of occasions in the previous year, using patient profiles developed in a second study utilising routinely collected drug prescription information. These methods have been described elsewhere.¹⁴ Two different weighting factors were devised. The first was based on frequency of pharmacy visits to obtain anti-asthma medication and the second on frequency of pharmacy visits to have prescriptions filled for β -agonist drugs. The weighting factors were calculated by dividing the population distribution (using the patient profile) by the sample distributions (using the questionnaire survey data).

RESULTS

1995 Pharmacy Exit Survey

Six hundred and eighty three purchasers of anti-asthma medications aged 15 years and over were asked to fill in the one page written questionnaire. Of these 507 agreed giving a response rate of 74.2 per cent. Eighteen respondents reported chronic sputum production without being diagnosed with asthma and were excluded from further analysis.

The median age of the respondents was 40 years with 47.9 per cent being male compared with 36 years and 53.8 per cent respectively for non-respondents. Ninety per cent of respondents had been diagnosed with asthma by a doctor compared with 86 per cent of non-respondents. Forty three per cent of respondents and 40.5 per cent of non-respondents reported chronic sputum production. The proportion of non-respondents obtaining their β -agonist inhalers over the counter on this occasion was 55.6 per cent compared with 40.2 per cent of respondents. Of the respondents 20.5 per cent reported that they always, and a further 14.9 per cent reported that they usually obtained their β -agonist medications over the counter, while 51.1 per cent indicated that they always and 13.5 per cent usually used a prescription to obtain their β -agonist medication.

The respondents were more likely to have had their asthma diagnosed by a doctor (OR = 2.09, P = 0.022) and less likely to have obtained their anti-asthma medication 'over the counter' on this occasion (OR = 0.54, P = 0.00082). There was no significant

difference between the respondents and non-respondents in age ($P = 0.055$), the proportion of males ($OR = 0.79$, $P = 0.186$), nor the proportion who reported chronic cough and sputum ($OR = 0.93$, $P = 0.741$).

Respondent classification as either mainly obtaining their anti-asthmatic medications over the counter (the OTC group) or by prescription (the prescription group) was based upon their self reported frequency of using a doctors prescription to obtain β -agonist inhalers. Of the 507 respondents 35.4 per cent reported never (20.5 per cent) or mostly not (14.9 per cent) using a prescription to obtain inhalers. These respondents were classified as mainly obtaining inhalers over the counter. Of the respondents 64.6 per cent reported mostly (13.5 per cent) or always (51.1 per cent) using a prescription to obtain inhalers and were hence categorised as mainly obtaining their inhalers by prescription.

A comparison of those respondents predominantly obtaining their β -agonist inhalers over the counter and those using a prescription is shown in Table 1. The OTC group was (using a t-test) older ($P = 0.001$), more predominantly male ($OR = 1.74$, $P = 0.004$), and less likely to report chronic cough and sputum ($OR = 0.52$, $P = 0.006$) than the prescription group. There was no difference found in the proportion having asthma diagnosed by the doctor ($OR = 0.98$, $P = 0.956$).

Of the respondents 69.6 per cent reported at least daily use of their β -agonist inhalers and 18.1 per cent at least five times daily use, 60.6 per cent reported wheezing at least most days and 28.5 per cent every day, 51.0 per cent reported at least five attacks within the previous twelve months and 36.5 per cent reported at least ten attacks. Of

the respondents 55.0 per cent had been admitted to hospital with 'asthma' or 'wheeze' at least once previously and 13.7 per cent were admitted within the previous year.

These potential measures of disease severity were compared between the two groups (Table 2). The OTC group was less likely to report wheezing at least once per week (OR = 0.59; 95% CI = 0.39-0.96; P = 0.0320) as well as at least most days (OR = 0.55; 95% CI = 0.36-0.84; P = 0.0052). In the crude analysis, the OTC group was less likely to report wheezing every day (OR = 0.52, P = 0.004) however after adjusting for differences in age and sex, this difference was not significant (OR = 0.66, 95% CI = 0.40-1.07; P = 0.0945).

The prescription group was more likely to have had at least 5 attacks in the last year (OR = 0.47, P = 0.001) and to have had at least 10 attacks in the last year (OR = 0.47, P = 0.0035). The prescription group was also more likely to have been admitted to hospital within the last 12 months for asthma or wheeze (OR = 0.31, P = 0.0009), to use their β -agonist puffer at least daily (OR = 0.64, P = 0.0451), and to make more than 25 visits to the pharmacy in the last 12 months to obtain medication (OR = 0.42, P = 0.0112). There were no significant differences found in the proportion of people who had ever been admitted to hospital for asthma or wheeze (OR = 0.79, P = 0.2746) or in those reporting use of β -agonist puffers at least 5 times daily (OR = 0.79, P = 0.4122).

Weighted and crude prevalence estimates of factors related to the management of adult asthma for the total population and compared between the OTC group and the prescription group are shown in Table 3.

The OTC group was less likely to have; objective airways measurement by the doctor 'usually' or 'always' (OR = 0.37; 95% CI = 0.21-0.67; P = 0.0011), possession of a written action plan (OR = 0.48; 95% CI = 0.26-0.88; P = 0.0184), regular medical review at least once per year (OR = 0.50; 95% CI = 0.27-0.93; P = 0.0297), and regular medical review at least twice per year (OR = 0.32; 95% CI = 0.17-0.64; P = 0.0009).

The proportion of adult asthmatics who use various medications are presented in Table 4. It is estimated that 55.0 per cent regularly used inhaled preventative medications (corticosteroids or sodium cromoglycate), 10.7 per cent regularly used ipratropium bromide, and 9.58 per cent regularly use theophylline. An estimated 5.81 per cent regularly use oral corticosteroids. Antibiotics were regularly used by 15.3 per cent of respondents.

The OTC group was less likely to regularly use inhaled preventative medications (OR = 0.29; 95% CI = 0.16-0.51; P = 0.0001), inhaled corticosteroids (Adjusted OR = 0.35; 95% CI = 0.20-0.60; P = 0.0001), ipratropium (OR = 0.27; 95% CI = 0.09-0.88; P = 0.0289) and theophylline (OR = 0.30; 95% CI = 0.11-0.79; P = 0.0151). The OTC group was also less likely to have used inhaled corticosteroids (OR = 0.35; 95% CI = 0.21-0.61; P = 0.0002), ipratropium (OR = 0.44; 95% CI = 0.20-0.94; P = 0.0480) and theophylline (OR = 0.43; 95% CI = 0.20-0.94, P = 0.0348) for chest problems at any time within the previous six months.

Changes between 1991 and 1995

There was a slight but insignificant increase in the proportion of respondents using a prescription to obtain β -agonist inhalers from 61.2 per cent in 1991 to 64.6 per cent in 1995. The 1991 and 1995 respondents were similar in terms of age, sex, proportion reporting asthma diagnosis by doctor and chronic cough and sputum for at least three months continually.

The decline in use of β -agonist puffers at least daily from 75.3 per cent in 1991 to 69.6 per cent in 1995 was of marginal significance (OR = 10.8; 95% CI = 1.00-1.16; P = 0.0500). Slight reductions were noted on frequency of wheezing, frequency of attacks of asthma or wheeze, and in hospital admission within the last 12 months, however these improvements were not statistically significant.

Various non-drug management factors were compared between 1991 and 1995 as shown in Table 5. After adjusting for potential measures of disease severity, age and sex, the differences between 1991 and 1995 were not statistically significant.

A comparison between 1991 and 1995 of the use of various medications is shown in Table 6. After adjusting for age, sex, and potential measures of disease severity, differences in use of inhaled corticosteroids, sodium cromoglycate and theophyllines were significant at the 0.05 level. Between 1991 and 1995 it is estimated that regular use of inhaled preventative medications increased from 44 per cent to 55 per cent and regular use of theophylline declined from 19.0 per cent in 1991 to 9.58 per cent in 1995.

No significant changes were found in the regular use or the use at any time of ipratropium, oral corticosteroids, and antibiotics in the previous six months.

DISCUSSION

The group predominantly obtaining their β -agonists over the counter is younger, more likely to be male, and less likely to report chronic cough and sputum. Males are less likely to go to the doctor than females¹⁵, and hence less likely to obtain a script. There are quite large financial benefits from obtaining various anti-asthma medications on prescription rather than over the counter for those people holding a concession card. β -agonists can be obtained for around a quarter of the price if a script and concession card is used. Holders of concession cards are generally older and hence use a script in order to obtain the financial benefits. Older people are also more likely to visit a general practitioner for problems other than asthma and may obtain scripts for anti-asthma medications on the same visit.

The proportion of respondents mainly obtaining their β -agonists by prescription, it is similar to the increase noted in a similar study in the Hunter Valley region of NSW in 1989.¹⁶ This group does not have routine review of their asthma as often as the prescription group, and are less likely to have a written action plan. It is unlikely that there would be an increase in the proportion using a prescription to obtain β -agonist inhalers without an increase in the proportion of people having routine medical review..

In 1991, the only significant difference in potential disease severity indicators between the OTC group and the prescription group were in hospital admissions for asthma or wheeze. In 1995 the differences between the OTC group and the prescription group were more prominent with regards to disease severity with the prescription group more likely to wheeze at least once per week, wheeze most or every day, have at least 5

attacks of asthma or wheeze in the last year, have at least 10 attacks of asthma or wheeze in the last year, to be admitted to hospital within the last 12 months for asthma or wheeze and to use a β -agonist inhaler at least daily. These differences were evident both in the crude analysis and after adjusting for age and sex. This suggests that the gap between the OTC group and the prescription group with regards to disease severity may be widening.

The prescription group has better asthma management practices particularly in relation to objective measurement by the doctor, routine medical review, and use of a written action plan. The National Asthma Strategy Goals and Targets set by the National Asthma Campaign aimed for 21 per cent of people to have a written action plan by the year 2000. The baseline for this target is 14 per cent of adults with a written action plan.¹⁷ A repeat of this survey in 1993 found the proportion of people with a written action plan to be 19.9 per cent.¹⁸ Therefore it can be seen that the Illawarra in 1995 had a reasonably good proportion of adults with written action plans (24.9 per cent) and the magnitude of the improvement since 1991 was similar to the National Asthma Campaign survey completed slightly earlier. The NAC sampling method was very different from that of the Illawarra survey. The NAC survey sampled parents of a random sample of primary schoolchildren. It is also possible that the weighting method used here in the Illawarra sample does not adequately adjust for the oversampling of people with more severe asthma in the OTC group. This methodology is appropriate for the prescription group as the weighting factors were developed from prescription data.

The proportion of the respondents reporting objective airways measurement by the doctor 'usually' or 'always' (28.4 per cent) and measurement of peak flow at home (27.0 per cent) were still low in 1995. The National Asthma Campaign survey reported that in 1993, 29.9 per cent of adult asthmatics had a peak flow meter and 44.4 per cent had their lung function measured by the doctor in the previous year.

The prescription group was more likely to use theophylline at any time in the previous six months (OR = 0.43; 95% CI = 0.20-0.94; P = 0.0343). This is a positive result as the unsupervised use of theophylline drugs is considered poor management. Overall, regular theophylline use decreased from 19.0 per cent to 9.6 per cent. This reduction in the use of theophyllines is not as great as that seen in the second evaluation survey done for the National Asthma Campaign. They report a significant reduction in theophylline use from 20.5 per cent in 1990 to 3.9 per cent in 1993.¹⁹ Differences were found in regular use of inhaled corticosteroids and ipratropium between the 'over the counter' group and the prescription group both in 1991 and 1995.

While there were slight improvements in most indicators of disease severity between 1991 and 1995, these changes were not significant except in relation to the frequency of use of β -agonist inhalers. Reductions in the proportion of people using β -agonist inhalers between at least a few times a week and at least daily suggest improved asthma management. Changes in prescribing which have been made are in accordance with the Asthma Management Plan with increased prescribing of inhaled corticosteroids and a reduction in the reliance on regular use of β -agonist inhalers. These changes have occurred in those people who have a moderate usage of β -agonist inhalers rather than those with a very high usage of β -agonist inhalers.

While most non-medication related management indicators improved slightly between 1991 and 1995, these changes were not significant. This is possibly due to a lack of statistical power and/or that the emphasis of the asthma management plan and local initiatives has been on better prescribing.

There has undoubtedly been an improvement in the prescribing of anti-asthma drugs in the Illawarra between 1991 and 1995. Significant improvements in the regular use of either inhaled corticosteroids or cromoglycate and a dramatic decrease in use of theophylline indicates changes in prescribing in line with the recommendations of the asthma management plan. The changes in preventative maintenance therapy have not been as great as those put forward in the National Asthma Campaign goals and targets document. The target is for 80 per cent of the adult asthmatic population to use preventative maintenance therapy by 1996, based upon a baseline measure of 39 per cent in 1990.²⁰ The National Asthma Campaign survey reported 38 per cent using inhaled corticosteroids or sodium cromoglycate in 1990. This increased to 43 per cent by 1993.²¹ The increase in the Illawarra from 44 per cent in 1991 to 55 per cent in 1995 suggests a higher baseline and a greater increase in the Illawarra, however this may reflect the different surveillance methods used for the national and Illawarra estimates. This increase was significant after adjusting for age, sex and potential measures of disease severity (Adjusted OR = 0.87; 95% CI = 0.80-0.95; P = 0.0019).

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Table 1: Comparison of 'OTC group' and 'Prescription group' 1995

	OTC group n=171	Prescription group n=312	Odds ratio (95% CI)	P value
age (years)*	34.0 (31)	48.5 (50)	-	0.001
sex (M)	56.6% [†]	42.8% [‡]	1.74 (1.17-2.60)	0.004
asthma diagnosis by doctor	93.7% [£]	93.8% ^{**}	0.98 (0.39-2.49)	0.956
chronic cough and sputum	32.5% ^{††}	48.1% ^{‡‡}	0.52 (0.32-0.85)	0.006

* Mean ages reported with median ages in parentheses. Difference tested using a t-test.

[†] n=168

[‡] n=297

[£] n=142

^{**} n=242

^{††} n=120

^{‡‡} n=210

Table 2: Potential measures of disease severity compared between the 'OTC group' and the 'Prescription group'

	OTC group n=171	Prescription group n=309	Adjusted odds ratio (95% CI)	P value
wheeze most or every day	49.1%*	67.0% [†]	0.55 (0.36-0.84)	0.0052
wheeze every day	20.4%*	33.0% [†]	0.66 (0.40-1.07)	0.0945
at least 5 attacks in the last year	39.2%	57.6%	0.54 (0.35-0.80)	0.0039
at least 10 attacks last year	25.7%	42.4%	0.51 (0.33-0.80)	0.0035
hospital admission ever for asthma or wheeze	54.8% [‡]	55.1% [†]	0.79 (0.52-1.20)	0.2746
hospital admission within the last 12 months	7.14% [‡]	17.4% [†]	0.31 (0.16-0.62)	0.0009

* n=167

[†] n=303

[‡] n=168

[†] n=305

Table 3: Weighted (and crude) prevalence estimates of factors related to the management of adult asthma compared between the 'OTC group' and the 'Prescription group'

	Total population n=482	OTC group n=171	Prescription group n=311	Adjusted odds ratio (95% CI)	P value
objective airways measurement by the doctor 'usually' or 'always'	27.9% (31.1%)	25.4% (23.4%)	32.2%* (35.4%)	0.37 (0.21-0.67)	0.0011
peak flow readings at home	28.1% (31.0%)	26.2% (25.7%)	27.8%† (34.0%)	0.67 (0.38-1.17)	0.1597
instruction in inhaler technique	92.8% (93.4%)	92.8% (91.8%)	93.3% (94.2%)	0.87 (0.37-2.01)	0.7407
written action plan	24.7% (27.8%)	20.5% (20.5%)	27.6% (31.8%)	0.48 (0.26-0.88)	0.0184
regular medical review at least once per year	53.7% (60.2%)	45.3%‡ (42.2%)	60.7% ^f (70.3%)	0.50 (0.27-0.93)	0.0297
regular medical review at least twice per year	40.3% (48.4%)	33.6%‡ (27.4%)	47.9% ^f (60.3%)	0.32 (0.17-0.64)	0.0009

* n=308

† n=306

‡ n=135

^f n=239

Table 4: Weighted (and crude) prevalence estimates of the use medications during the previous six months compared between the 'OTC group' and the 'Prescription group'

	Total Population n=483	OTC group n = 171	Prescription group n = 312	Adjusted odds ratio (95% CI)	P value
Regular inhaled corticosteroids or cromoglycate	57.7% (61.9%)	55.9% (50.3%)	59.5% (68.3%)	0.29 (0.16-0.51)	0.0001
Regular ipratropium bromide	11.1% (17.6%)	5.96% (5.26%)	14.8% (24.4%)	0.27 (0.09-0.88)	0.0289
Regular theophylline	9.49% (12.8%)	8.12% (7.02%)	8.90% (16.0%)	0.30 (0.11-0.79)	0.0151
Any inhaled corticosteroids	57.2% (60.0%)	57.0 (51.5%)	58.2% (64.7%)	0.35 (0.21-0.61)	0.0002
Any sodium cromoglycate	15.7% (18.4%)	16.0 (15.8%)	15.4% (19.9%)	0.85 (0.43-1.66)	0.6260
Any ipratropium bromide	16.2% (23.0%)	13.6% (11.1%)	18.3% (29.5%)	0.44 (0.20-0.94)	0.0480
Any theophylline	14.0% (18.6%)	11.9% (11.1%)	14.7% (29.5%)	0.43 (0.20-0.94)	0.0348

Table 5: Weighted (and crude) prevalence estimates of factors related to the management of adult asthma compared between the 1991 and 1995 respondents

	1991 n=422	1995 n=490	Adjusted odds ratio (95% CI)	P value
objective airways measurements by the doctor 'usually' or 'always'	24.1% (28.2%)	28.4%* (31.4%)	0.96 (0.88-1.05)	0.4036
peak flow readings at home	19.5% [†] (24.5%)	27.0% [‡] (31.3%)	0.94 (0.86-1.03)	0.2060
instruction in inhaler technique	89.6% [£] (91.9%)	90.9% (93.1%)	1.02 (0.88-1.18)	0.7658
written action plan	18.4% (22.8%)	24.9% (27.6%)	0.97 (0.89-1.07)	0.5807
regular medical review at least once per year	46.5%** (51.6%)	53.9% ^{††} (60.2%)	0.92 (0.83-1.02)	0.1127
regular medical review at least twice per year	36.2%** (43.3%)	39.7% ^{††} (48.6%)	0.94 (0.84-1.04)	0.2119

* n=487

† n=421

‡ n=485

£ n=417

** n=314

†† n=379

Table 6: Weighted (and crude) prevalence estimates of the use of medications during the previous six months compared between 1991 and 1995

respondents

	1991 n = 421	1995 n = 491	Adjusted odds ratio (95% CI)	P value
Regular inhaled corticosteroids or cromoglycate	43.7% (51.1%)	55.0% (62.1%)	0.87 (0.80-0.95)	0.0019
Regular ipratropium bromide	9.14% (14.0%)	10.7% (17.5%)	0.91 (0.81-1.03)	0.1542
Regular theophylline	19.0% (24.2%)	9.58% (13.0%)	1.27 (1.14-1.41)	0.0001
Regular oral corticosteroids	6.00% (8.39%)	5.81% (8.76%)	0.98 (0.86-1.13)	0.7894
Regular antibiotics	16.0% (15.2%)	15.3% (16.3%)	1.01 (0.91-1.13)	0.8277
Any inhaled corticosteroids	47.0% (54.6%)	55.4% (60.1%)	0.94 (0.86-1.02)	0.1392
Any sodium cromoglycate	11.2% (13.5%)	13.5% (18.7%)	0.87 (0.77-0.97)	0.0117
Any theophylline	25.8% (32.6%)	13.5% (18.7%)	1.27 (1.15-1.40)	0.0001

APPENDIX 2

Contents:

A2.1 1991 Participants Information Sheet

A2.2 1991 Pharmacy Exit Survey Questionnaire



ILLAWARRA PUBLIC HEALTH UNIT

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TELL US ABOUT YOUR CHEST

You may have heard that the Illawarra Pharmacists and the Illawarra Public Health Unit are doing a study about asthma in the Illawarra.

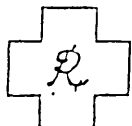
As you know asthma is an important health problem. To give the best possible treatment we need to know more about who's suffering from chest problems, how badly people are suffering and what treatment people are having for their asthma at the moment.

Therefore, we are asking for 3 minutes of your time to complete this confidential questionnaire about your chest. The questionnaire is on the reverse side of this sheet. It is only a page long and for most questions only a tick is needed. We do not need your name, only your age and sex.

It is important that as many people as possible complete these questionnaires. Your help will be most appreciated. The pharmacist will be pleased to assist you if you have any difficulties.

THANK YOU FOR YOUR COOPERATION.

CONFIDENTIAL



ILLAWARRA PHARMACISTS' ASSOCIATION

Sex: M F Age: _____ years

1. How often do you use this inhaler (puffer) ? (Ventolin, Respolin, Berotec, Bricanyl or Alupent)	less than once/week <input type="checkbox"/>	once a week <input type="checkbox"/>	a few times per week <input type="checkbox"/>	
	1-4 times a day <input type="checkbox"/>	5-10 times a day <input type="checkbox"/>	more than 10 times a day <input type="checkbox"/>	
2. How often do you wheeze?	every day <input type="checkbox"/>	most days <input type="checkbox"/>	about once a week <input type="checkbox"/>	less than once a week <input type="checkbox"/>
3. Do you use a doctor's prescription to obtain your inhaler?	never <input type="checkbox"/>	mostly not <input type="checkbox"/>	mostly <input type="checkbox"/>	always <input type="checkbox"/>
4. Has a doctor or other health worker ever shown you how to use your inhaler correctly?			Yes <input type="checkbox"/>	No <input type="checkbox"/>
If YES, who? (eg. doctor, pharmacist, physio, nurse, hospital casualty) _____				
5. How many attacks of asthma or wheezing have you had in the last year?	none <input type="checkbox"/>	1 - 4 <input type="checkbox"/>	5 - 10 <input type="checkbox"/>	more than 10 <input type="checkbox"/>
6. How often does your doctor measure your breathing with a peak flow meter or other device?	never <input type="checkbox"/>	occasionally <input type="checkbox"/>	usually <input type="checkbox"/>	always <input type="checkbox"/>
7. Do you measure your own peak flow at home?			Yes <input type="checkbox"/>	No <input type="checkbox"/>
8. Do you usually visit a doctor about your chest: a. When your chest is causing you problems? b. For regular review, even if your chest is not causing problems? If YES to b. - how often?			Yes <input type="checkbox"/>	No <input type="checkbox"/>
		less than once a year <input type="checkbox"/>	Yes <input type="checkbox"/>	No <input type="checkbox"/>
9. Have you been admitted to hospital with asthma or wheezing? (tick one)		no, never <input type="checkbox"/>	yes, not in last year <input type="checkbox"/>	yes, in last year <input type="checkbox"/>
10. Do you have a written plan of what to do when you have an attack?			Yes <input type="checkbox"/>	No <input type="checkbox"/>
11. During the last 6 months which of the following medications have you taken for your chest? (For each group, you may tick none, one or two boxes.)		most of the time		in bad attacks
a. Ventolin, Respolin, Berotec, Bricanyl, Alupent		a <input type="checkbox"/>	a <input type="checkbox"/>	
b. Atrovent		b <input type="checkbox"/>	b <input type="checkbox"/>	
c. Intal		c <input type="checkbox"/>	c <input type="checkbox"/>	
d. Becotide, Becloforte or Aldecin		d <input type="checkbox"/>	d <input type="checkbox"/>	
e. Nuelin, Theodur, Elixophyllin, Choledyl, Brondecon		e <input type="checkbox"/>	e <input type="checkbox"/>	
f. Cortisone, Celestone, Prednisolone		f <input type="checkbox"/>	f <input type="checkbox"/>	
g. Antihistamines eg: Avil, Polaramine, Zadine, Demazin, Teldane		g <input type="checkbox"/>	g <input type="checkbox"/>	
h. Antibiotics eg: Penicillin, Abbecillin, Amoxyl, Augmentin, Doryx, Ceclor, Mysteclin, Vibramycin, Vibra-Tabls, Kelfex, Bactrim, Septrin, etc		h <input type="checkbox"/>	h <input type="checkbox"/>	
12. How many times during the last 12 months have you visited a pharmacy to obtain medication for your chest?		none <input type="checkbox"/>	1 - 2 <input type="checkbox"/>	3 - 4 <input type="checkbox"/>
		5 - 10 <input type="checkbox"/>	11 - 25 <input type="checkbox"/>	more than 25 <input type="checkbox"/>

APPENDIX 3

Contents:

A3.1 1995 Participants Information Sheet

A3.2 1995 Pharmacy Exit Survey Questionnaire



Illawarra Public Health Unit

University of Wollongong

Illawarra Area Health Service



18 Madoline Street
GWYNNEVILLE NSW 2500
Telephone: (042) 26 4677

(Postal Address)
PO Box 66
KEIRAVILLE NSW 2500
Facsimile: (042) 26 4917

TELL US ABOUT YOUR CHEST

You may have heard that the Illawarra Pharmacists and the Illawarra Public Health Unit are doing a study about asthma in the Illawarra. We conducted this study first in Aug-Sept 1991. This present study is intended to be a repeat of that study to see if asthma management has improved.

As you know asthma is an important health problem. To give the best possible treatment we need to know more about who's suffering from chest problems, how badly people are suffering and what treatment people are having for their asthma at the moment.

Therefore, we are asking for 3 minutes of your time to complete this confidential questionnaire about your chest. The questionnaire is on the reverse side of this sheet. It is only a page long and for most questions only a tick is needed. We do not need your name, only your age and sex. You are under no obligation to complete the questionnaire though we would appreciate you doing so.

It is important that as many people as possible complete these questionnaires. Your help will be most appreciated. The pharmacist will be pleased to assist you if you have any difficulties.

If you have any enquiries regarding the conduct of the research please contact the Secretary of the University of Wollongong Human Research Ethics Committee on (042) 213 457.

I understand the data collected will be used for a repeat study into asthma management and I consent for the data to be used in that manner.

If you wish to take part in this research please sign below:

....././..

“working together for a healthier community”

PHARMACY EXIT SURVEY

SEX: M F Age: _____ years

1. How often do you use an inhaler (puffer)? Ventolin, Respolin, Berotec, Bricanyl, Alupent, Asmol, Serevent only	less than once/week <input type="checkbox"/> 1-4 times a day <input type="checkbox"/>	once a week <input type="checkbox"/> 5-10 times a day <input type="checkbox"/>	a few times per week more than 10 times a day <input type="checkbox"/>
2. How often do you wheeze?	every day <input type="checkbox"/>	most days <input type="checkbox"/>	about once a week <input type="checkbox"/> less than once a week <input type="checkbox"/>
3. Do you use a doctor's prescription to obtain this inhaler	never <input type="checkbox"/>	mostly not <input type="checkbox"/>	mostly <input type="checkbox"/> always <input type="checkbox"/>
4. Has your doctor or other health worker ever shown you how to use your inhaler correctly?	Yes <input type="checkbox"/>		No <input type="checkbox"/>
If YES, who ? (e.g. doctor, pharmacist, physio, nurse, hospital casualty):			
5. How many attacks of asthma or wheezing have you had in the last year?	none <input type="checkbox"/>	1-4 <input type="checkbox"/>	5-10 <input type="checkbox"/> more than 10 <input type="checkbox"/>
6. How often does your doctor measure your breathing with a peak flow meter or other device?	never <input type="checkbox"/>	occasionally <input type="checkbox"/>	usually <input type="checkbox"/> always <input type="checkbox"/>
7. Do you measure your own peak flow meter at home?	Yes <input type="checkbox"/>		No <input type="checkbox"/>
8. Do you usually visit a doctor about your chest: a. When your chest is causing problems ? b. For regular review, even if your chest is not causing problems ? If Yes to b, - how often ?	Less than once a year <input type="checkbox"/>	Yes <input type="checkbox"/> Yes <input type="checkbox"/> Once a year <input type="checkbox"/>	No <input type="checkbox"/> No <input type="checkbox"/> Twice or more a year <input type="checkbox"/>
9. Have you been admitted to hospital with asthma or wheezing? (tick one)	no, never <input type="checkbox"/>	yes, not in last year <input type="checkbox"/>	yes, in last year <input type="checkbox"/>
10. Do you have a written plan of what to do when you have an attack?	Yes <input type="checkbox"/>		No <input type="checkbox"/>
11. During the last 6 months which of the following medications have you taken? (tick one or more)	most of the time	in bad attacks	
a. Ventolin, Respolin, Berotec, Bricanyl, Alupent, Asmol, Serevent	a <input type="checkbox"/>	a <input type="checkbox"/>	
b. Atrovent, Tilade, Flixotide	b <input type="checkbox"/>	b <input type="checkbox"/>	
c. Intal	c <input type="checkbox"/>	c <input type="checkbox"/>	
d. Becotide, Becloforte, Aldecin or Pulmicort	d <input type="checkbox"/>	d <input type="checkbox"/>	
e. Nuelin, Theodur, Elixophyllin, Choledyl or Brondecon	e <input type="checkbox"/>	e <input type="checkbox"/>	
f. Cortisone, Celestone or Prednisolone	f <input type="checkbox"/>	f <input type="checkbox"/>	
g. Antihistamines e.g.: Avil, Polaramine, Zadine, Demazin, Teldane	g <input type="checkbox"/>	g <input type="checkbox"/>	
h. Antibiotics e.g.: Penicillin, Abbocillin, Amoxyl, Augmentin, Doryx, Ceclor, Mysteclin, Vibramycin, Vibra-Tabs, Keflex, Bactrim, Septrin, Rulide, Erythromycin etc.	h <input type="checkbox"/>	h <input type="checkbox"/>	
12. How many times during the last 12 months have you visited a pharmacy to obtain medication for your chest?	none <input type="checkbox"/> 5-10 <input type="checkbox"/>	1-2 <input type="checkbox"/> 11-25 <input type="checkbox"/>	3-4 <input type="checkbox"/> more than 25 <input type="checkbox"/>
13. During the last 12 months how many times have you been to a community pharmacy to have a prescription filled for any of the following: Ventolin, Respolin, Berotec, Bricanyl, Alupent, Asmol, Serevent?	none <input type="checkbox"/> 5-10 <input type="checkbox"/>	1-2 <input type="checkbox"/> 11-25 <input type="checkbox"/>	3-4 <input type="checkbox"/> more than 25 <input type="checkbox"/>

APPENDIX 4 : Results of reanalysis of 1991 Pharmacy Exit Survey

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Table A4.1: Comparison of questionnaire respondents and non-respondents

Table A4.2: Comparison of 'OTC group' and 'Prescription group'

Table A4.3: Potential measures of disease severity compared between the 'OTC group' and the 'Prescription group'

Table A4.4: Weighted (and crude) prevalence estimates of factors related to the management of adult asthma compared between the 'OTC group' and the 'Prescription group'

Table A4.5: Weighted (and crude) prevalence estimates of the use medications regularly during the previous six months compared between the 'OTC group' and the 'Prescription group'

Table A4.6: Weighted (and crude) prevalence estimates of use of medications at any time during the previous six months compared between the 'OTC group' and the 'Prescription group'

Table A4.1: Comparison of questionnaire respondents and non-respondents

	Respondents	Non-respondents	Odds Ratio (95% CI)	P value
age (years)*	42.2 (40) n = 429	38.2 (32) n = 107	-	0.036
sex (M)	53.3% n = 422	54.1% n = 98	0.97 (0.61-1.54)	0.891
asthma diagnosis by doctor	95.4% n = 324	87.2% n = 94	3.01 (1.27-7.14)	0.005
chronic cough and sputum	46.2% n = 238	44.7% n = 74	1.26 (0.72-2.22)	0.391
obtained medication 'over-the-counter'	42.6% n = 312	64.6% n = 99	0.41 (0.25-0.67)	0.00013

* Mean ages reported with median ages in parentheses. Difference tested using a t-test.

Table A4.2: Comparison of 'OTC group' and 'Prescription group'

	OTC group	Prescription group	Odds ratio (95% CI)	P value
age (years)*	35.1 (32) n = 164	46.6 (47) n = 259	-	0.001
sex (M)	62.2% n = 164	48.8% n = 252	1.73 (1.13-2.63)	0.007
asthma diagnosis by doctor	94.4% n = 126	95.9% n = 194	0.73 (0.23-2.31)	0.554
chronic cough and sputum	31.9% n = 91	54.5% n = 145	0.39 (0.22-0.70)	0.001

* Mean ages reported with median ages in parentheses. Difference tested using a t-test.

Table A4.3: Potential measures of disease severity compared between the 'OTC group' and the 'Prescription group'

	OTC group	Prescription group	Crude odds ratio (95% CI)	Adjusted odds ratio (95% CI)	P value
wheeze at least once per week	76.3% n = 156	79.7% n = 246	0.82 (0.49-1.37)	0.83 (0.39-1.04)	0.4628
wheeze most or every day	57.1% n = 156	67.5% n = 246	0.64 (0.41-0.99)	0.75 (0.48-1.16)	0.1984
wheeze every day	21.8% n = 156	34.2% n = 246	0.54 (0.33-0.87)	0.64 (0.50-1.38)	0.0700
at least 5 attacks in the last year	52.8% n = 163	54.7% n = 256	0.93 (0.61-1.40)	1.01 (0.66-1.53)	0.9662
at least 10 attacks last year	35.6% n = 163	42.2% n = 256	0.76 (0.49-1.16)	0.85 (0.55-1.31)	0.4548
hospital admission ever for asthma or wheeze	43.2% n = 162	55.0% n = 258	0.62 (0.41-0.94)	0.64 (0.42-0.97)	0.0370
hospital admission within the last 12 months	7.41% n = 162	19.4% n = 258	0.33 (0.16-0.67)	0.37 (0.18-0.73)	0.0046
use of beta-agonist puffer at least daily	68.8% n = 160	79.3% n = 256	0.57 (0.36-0.92)	0.77 (0.48-1.24)	0.2903
use of beta-agonist puffer at least 5 times daily	10.6% n = 162	18.4% n = 258	0.53 (0.28-0.99)	0.71 (0.37-1.34)	0.2916
more than 25 visits to pharmacy for medication	9.94% n = 161	25.8% n = 256	0.32 (0.17-0.59)	0.43 (0.23-0.79)	0.0070

Table A4.4: Weighted (and crude) prevalence estimates of factors related to the management of adult asthma compared between the 'OTC group' and the 'Prescription group'

	Total population	OTC group	Prescription group	Crude odds ratio (95% CI)	Adjusted odds ratio (95% CI)	P value
objective airways measurement by the doctor 'usually' or 'always'	24.1% (28.4%)	14.7% (16.6%) n = 163	31.2% (35.9%) n = 256	0.35 (0.21-0.59)	0.44 (0.24-0.83)	0.0107
peak flow readings at home	19.5% (24.4%)	16.6% (19.1%) n = 162	22.6% (27.7%) n = 256	0.62 (0.37-1.02)	0.59 (0.32-1.09)	0.0942
instruction in inhaler technique	89.6% (91.9%)	90.9% (90.2%) n = 163	88.6% (93.0%) n = 256	0.69 (0.33-1.48)	1.28 (0.51-3.23)	0.6008
written action plan	18.4% (23.0%)	14.9% (17.1%) n = 158	21.2% (26.6%) n = 256	0.57 (0.34-0.96)	0.65 (0.35-1.22)	0.1805
regular medical review at least once per year	46.5% (51.6%)	26.5% (28.6%) n = 119	58.5% (66.0%) n = 191	0.21 (0.12-0.35)	0.31 (0.17-0.59)	0.0003
regular medical review at least twice per year	36.2% (43.6%)	19.6% (21.9%) n = 119	45.0% (57.1%) n = 191	0.21 (0.12-0.36)	0.35 (0.18-0.67)	0.0017

Table A4.5: Weighted (and crude) prevalence estimates of the use medications regularly during the previous six months compared between the 'OTC group' and the 'Prescription group'

	Total population n = 423	OTC group n = 164	Prescription group n = 259	Crude odds ratio	Adjusted odds ratio (95% CI)	P value
inhaled corticosteroids or cromoglycate	43.7% (51.5%)	35.3% (38.4%)	49.0% (59.9%)	0.42 (0.27- 0.64)	0.54 (0.31- 0.92)	0.0240
inhaled corticosteroids	39.3% (46.8%)	32.0% (34.2%)	44.7% (54.8%)	0.43 (0.28- 0.65)	0.49 (0.28- 0.83)	0.0087
cromoglycate	9.12% (10.4%)	10.8% (10.4%)	8.08% (10.4%)	0.99 (0.50- 1.97)	2.44 (0.95- 6.27)	0.0642
ipratropium	9.14 (14.2%)	2.50% (3.66%)	12.7% (20.9%)	0.14 (0.05- 0.36)	0.29 (0.10- 0.83)	0.0216
theophylline	19.0 (24.6%)	14.7% (14.0%)	23.3% (31.3%)	0.36 (0.21- 0.62)	0.59 (0.30- 1.16)	0.1271
oral corticosteroids	6.00 (8.51%)	1.74% (2.44%)	8.87% (12.4%)	0.18 (0.05- 0.54)	0.19 (0.05- 0.70)	0.0124
antibiotics	16.0 (15.4%)	10.1% (9.76%)	19.8% (18.9%)	0.46 (0.24- 0.88)	0.48 (0.22- 1.06)	0.0686

Table A4.6: Weighted (and crude) prevalence estimates of use of medications at any time during the previous six months compared between the 'OTC group' and the 'Prescription group'

	Total population n = 428	OTC group n = 164	Prescription group n = 259	Crude odds ratio (95% CI)	Adjusted odds ratio (95% CI)	P value
inhaled corticosteroids	47.0% (55.1%)	40.0% (43.3%)	53.0% (62.6%)	0.46 (0.30- 0.69)	0.50 (0.30- 0.86)	0.0122
cromoglycate	11.2% (13.5%)	12.8% (13.4%)	10.3% (13.5%)	0.99 (0.54- 1.82)	1.85 (0.83- 4.12)	0.1346
ipratropium	13.9% (20.6%)	8.07% (9.76%)	17.0% (27.4%)	0.29 (0.15- 0.53)	0.34 (0.16- 0.74)	0.0063
theophylline	25.8% (33.1%)	22.0% (24.4%)	29.2% (27.4%)	0.51 (0.32- 0.81)	0.73 (0.41- 1.30)	0.2896
oral corticosteroids	15.4% (21.8%)	11.1% (14.0%)	19.0% (26.6%)	0.45 (0.26- 0.78)	0.66 (0.33- 1.31)	0.2332
antihistamines	12.9% (13.7%)	14.8% (14.6%)	12.1% (13.1%)	1.13 (0.62- 2.06)	0.90 (0.44- 1.83)	0.7683
antibiotics	35.0% (31.9%)	27.7% (27.4%)	40.0% (42.9%)	0.50 (0.32- 0.79)	0.48 (0.28- 0.83)	0.0090

APPENDIX 5: Tables of weighted and crude prevalence estimates of management factors and use of medication. Weighting factors are based upon self reported frequency of pharmacy visits to obtain anti-asthma medication.

Contents:

Table A5.1: Weighted (and crude) prevalence estimates of factors related to the management of adult asthma compared between the 'OTC group' and the 'Prescription group'

Table A5.2: Weighted (and crude) prevalence estimates of the use medications regularly during the previous six months compared between the 'OTC group' and the 'Prescription group'

Table A5.3: Weighted (and crude) prevalence estimates of use of medications at any time during the previous six months compared between the 'OTC group' and the 'Prescription group'

Table A5.1: Weighted (and crude) prevalence estimates of factors related to the management of adult asthma compared between the 'OTC group' and the 'Prescription group'

	Total population	OTC group n =	Prescription group n =	Crude odds ratio (95% CI)	Adjusted odds ratio (95% CI)	P value
objective airways measurement by the doctor 'usually' or 'always'	28.4% (31.1%)	21.3% (23.4%) n = 171	32.5% (35.4%) n = 308	0.56 (0.36-0.87)	0.37 (0.21-0.67)	0.0011
peak flow readings at home	27.0% (31.0%)	21.7% (25.7%) n = 171	29.8% (34.0%) n = 306	0.69 (0.45-1.08)	0.67 (0.38-1.17)	0.1597
instruction in inhaler technique	90.9% (93.4%)	89.6% (91.8%) n = 171	92.0% (94.2%) n = 311	0.69 (0.32-1.51)	0.87 (0.37-2.01)	0.7407
written action plan	24.9% (27.8%)	18.9% (20.5%) n = 171	28.7% (31.8%) n = 311	0.55 (0.35-0.88)	0.48 (0.26-0.88)	0.0184
regular medical review at least once per year	53.9% (60.2%)	43.2% (42.2%) n = 135	60.7% (70.3%) n = 239	0.31 (0.19-0.49)	0.50 (0.27-0.93)	0.0297
regular medical review at least twice per year	39.7% (48.4%)	25.2% (27.4%) n = 135	48.4% (60.3%) n = 239	0.25 (0.15-0.40)	0.32 (0.17-0.64)	0.0009

Table A5.2: Weighted (and crude) prevalence estimates of the use medications regularly during the previous six months compared between the 'OTC group' and the 'Prescription group'

	Total population n = 483	OTC group n = 171	Prescription group n = 312	Crude odds ratio	Adjusted odds ratio (95% CI)	P value
inhaled corticosteroids or cromoglycate	55.0 (61.9%)	43.4% (50.3%)	61.6% (68.3%)	0.47 (0.31- 0.70)	0.29 (0.16- 0.51)	0.0001
inhaled corticosteroids	48.8% (54.2%)	37.9% (44.4%)	53.9% (59.6%)	0.54 (0.37- 0.80)	0.35 (0.20- 0.60)	0.0001
cromoglycate	13.4% (16.4%)	10.8% (11.7%)	14.6% (18.9%)	0.57 (0.32- 1.01)	0.67 (0.32- 1.37)	0.2679
ipratropium	10.7% (17.6%)	4.40% (5.26%)	14.5% (24.4%)	0.17 (0.08- 0.37)	0.27 (0.09- 0.88)	0.0289
theophylline	9.58% (12.8%)	5.07% (7.02%)	11.7% (16.0%)	0.40 (0.19- 0.79)	0.30 (0.11- 0.79)	0.0151
oral corticosteroids	5.81% (8.70%)	5.30% (5.85%)	6.20% (10.3%)	0.54 (0.24- 1.19)	1.45 (0.50- 4.21)	0.4974
antibiotics	15.3% (15.9%)	9.73% (11.1%)	18.2% (18.6%)	0.55 (0.24- 0.88)	0.83 (0.41- 1.70)	0.6118

Table A5.3: Weighted (and crude) prevalence estimates of use of medications at any time during the previous six months compared between the 'OTC group' and the 'Prescription group'

	Total population n = 477	OTC group n = 171	Prescription group n = 306	Crude odds ratio (95% CI)	Adjusted odds ratio (95% CI)	P value
inhaled corticosteroids	55.4% (60.0%)	47.0 (51.5%)	60.1% (64.7%)	0.58 (0.39-0.86)	0.35 (0.21-0.61)	0.0002
cromoglycate	15.7% (18.4%)	12.8% (15.8%)	15.7% (19.9%)	0.76 (0.45-1.28)	0.85 (0.43-1.66)	0.6260
ipratropium	15.5% (23.0%)	10.4% (11.1%)	18.4% (29.5%)	0.30 (0.17-0.53)	0.44 (0.20-0.94)	0.0480
theophylline	13.5% (18.6%)	7.79% (11.1%)	16.6% (29.5%)	0.42 (0.24-0.75)	0.43 (0.20-0.94)	0.0348
oral corticosteroids	18.4% (24.2%)	16.8% (19.9%)	19.3% (26.6%)	0.68 (0.42-1.10)	1.00 (0.52-1.94)	0.9916
antihistamines	15.3% (16.8%)	16.1% (18.7%)	15.4% (15.7%)	1.24 (0.73-2.07)	2.76 (1.38-5.52)	0.0042
antibiotics	35.1% (38.9%)	31.2% (32.8%)	37.2% (42.3%)	0.66 (0.44-1.00)	1.12 (0.66-1.88)	0.6791

APPENDIX 6: Comparison of 1991 and 1995 factors related to management with frequency of β -agonist use removed from the logistic regression model.

Contents:

Table A6.1: Weighted (and crude) prevalence estimates of factors related to the management of adult asthma compared between the 1991 and 1995 respondents

Table A6.1: Weighted (and crude) prevalence estimates of factors related to the management of adult asthma compared between the 1991 and 1995 respondents

	1991	1995	Crude odds ratio (95% CI)	Adjusted odds ratio (95% CI)	P value
objective airways measurements by the doctor 'usually' or 'always'	24.1% (28.2%) n = 422	28.4% (31.4%) n = 487	0.86 (0.64-1.15)	0.96 (0.88-1.05)	0.4036
peak flow readings at home	19.5% (24.5%) n = 421	27.0% (31.3%) n = 485	0.71 (0.52-0.96)	0.94 (0.85-1.03)	0.2060
instruction in inhaler technique	89.6% (91.9%) n = 421	90.9% (93.1%) n = 490	0.85 (0.50-1.43)	1.03 (0.89-1.19)	0.7658
written action plan	18.4% (22.8%) n = 417	24.9% (27.6%) n = 490	0.78 (0.57-1.06)	0.97 (0.89-1.07)	0.5807
regular medical review at least once per year	46.5% (51.6%) n = 314	53.9% (60.2%) n = 379	0.71 (0.52-0.97)	0.93 (0.84-1.03)	0.1127
regular medical review at least twice per year	36.2% (43.3%) n = 314	39.7% (48.6%) n = 379	0.81 (0.59-1.11)	0.93 (0.84-1.03)	0.2119

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