

Asthma Knowledge Among Adult Asthmatic Outpatients in a Tertiary Care Hospital

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Asthma is an important and common health problem in Singapore. It has been found that the prevalence of adult asthma in Singapore is 2.4% among men and 2.0% in women.¹ Asthma causes significant morbidity in our population, accounting for about 20,000 emergency room visits per year, and ranks as the fifth most common reason for hospital discharges.² The economic burden of asthma in Singapore, in terms of costs of medical care (inpatient, emergency room visits, specialist outpatient and primary healthcare) and medication, as well as cost of time lost by patients attending to medical needs and loss of productivity due to absenteeism, is estimated to be US\$ 33.93 million per annum.³

There is evidence that educating asthma patients about their condition is cost effective and reduces morbidity.^{4,5} The importance of patient education in the successful control of asthma has been recognized and is emphasized in a multitude of recent evidence-based

SUMMARY We conducted a prospective, cross sectional survey on 94 asthmatic subjects using an interviewer-administered questionnaire to audit the level of knowledge of adult asthmatic outpatients at a tertiary care hospital, in order to determine the sources of asthma information and variables associated with poor asthma knowledge. Of the 94 subjects, 39.4% were ignorant of the inflammatory nature of asthma while 56.4% did not understand the role of prednisolone in acute exacerbation of asthma. Only 17.0% reported having a written action plan. Lower educational level and older age were significantly associated with lower asthma knowledge scores. The doctor was the main source of asthma information. Asthma knowledge scores were significantly higher among those who named the doctor, pamphlets, newspapers, internet and books as a source of asthma information. Our study demonstrates that many asthmatics have poor understanding of some aspects of their disease and have no written asthma action plan.

local and international clinical practice guidelines on the management of asthma.⁶⁻¹⁰ With respect to patient education, the impact of these guidelines in the local and Asian context is largely unknown.

Only a few local studies have addressed patients' knowledge and understanding of asthma, and most were conducted prior to the introduction of these clinical guidelines, for example the Singapore Adult Asthma Morbidity Study (SAAMS) which was carried out in 1993.¹¹⁻¹³ Moreover, the subjects in these previously conducted studies

were asthmatic patients in primary care clinics.

Among asthmatics who are managed in the tertiary care setting, little is known to date about the level of their asthma knowledge since the advent of these clinical practice guidelines. These asthmatics constitute an important group of interest, as they tend to suffer from asthma of greater severity than those seen in primary care clinics, and are

more likely to utilize costly health-care services to a greater extent. Effective asthma education programs, leading to improved asthma knowledge and self-management skills and better control of asthma can potentially lower health care costs and relieve the strain on health-care services.

The primary aim of this study was to audit the level of knowledge of adult asthmatic outpatients at a tertiary care hospital. The secondary aims were to determine the sources of information on asthma and to identify variables associated with poor asthma knowledge.

MATERIALS AND METHODS

Study design and subjects

The study design was a prospective, cross sectional survey using an interviewer-administered questionnaire. The study subjects were adult outpatients seen at the Department of Respiratory and Critical Care Medicine of Singapore General Hospital from 3 May 2002 to 18 May 2002 who had a physician diagnosis of asthma and who were receiving treatment for their asthma. Singapore General Hospital is an acute tertiary care hospital and a national referral center, with a bed complement of 1,400 and an annual attendance of 600,000 at its specialist outpatient clinics. Subjects were approached while they were awaiting consultation with their physician and a single interviewer (one of the investigators, SMC) interviewed those who gave consent. Subjects who refused, who were too ill or who had a diagnosis of chronic obstructive pulmonary disease or other chronic respiratory disease were excluded. The questionnaire was available in

both English and Mandarin, and the interviewer was fluent in both languages. The study design and questionnaire were approved by the Ethics Committee, Singapore General Hospital and consent was obtained from each subject.

Formulation of questionnaire

Demographic data such as age, gender, race, highest educational level and housing type (as an indicator of socio-economic status)¹ were collected. In addition, data on whether the subjects had ever attended the Asthma Clinic and Education Centre (ACEC) at the Singapore General Hospital were obtained from patient records. Further details of the ACEC are provided in the appendix.

Questions 1 and 2 listed the various sources from which subjects may have obtained information on asthma (Appendix). For question 1, multiple responses were allowed. Subjects were also asked to choose the one source from which they had learnt the most about asthma in question 2.

The current clinical practice guidelines recommend that patients be educated on the following aspects of their condition: basic facts of a asthma, role of medications, attack management skills through use of a written action plan, inhaler technique, and environmental control measures.⁶⁻¹⁰ The questionnaire was designed to assess the first three aspects. Questions 3 to 5 aimed to assess knowledge of the basic mechanism of asthma. These statements were identical to the statements from the questionnaire used in the SAAMS.¹¹ Question 6 was included to determine whether sub-

jects were able to list their medications for asthma and whether they were able to correctly identify the roles of their reliever and preventer medications (Question 6 [i]) and (Question 6 [ii]).

For treatment of acute exacerbation of asthma, current guidelines recommend a short course of glucocorticosteroids.⁶⁻¹⁰ Question 7 was included to determine if subjects understood the role of a short course of prednisolone, typically prescribed for use in acute exacerbation of asthma.

The interviewer evaluated the responses of the subjects to the knowledge statements and awarded one point to each correct answer, while incorrect or unsure responses were accorded a zero score. Knowledge statements were analysed individually and as a summed score. This asthma knowledge score was computed by summing the scores of the 6 statements (questions 3 to 7). The lowest and highest total scores possible were 0 and 6, respectively.

The subjects were also asked if a member of the healthcare staff had discussed with them a written action plan to guide them when they suffered from an asthma attack. Asthmatic self-management plans, incorporating written guidelines for both long-term treatment of asthma and treatment of exacerbations, have been shown to result in significant reduction in morbidity and patients' need for health services and have been promoted in current asthma guidelines.⁶⁻¹⁰

Statistical analysis

Data were entered into a database file and scrutinized for

outliers and influential points. Statistical analysis was performed using Statistical Package for Social Sciences version 10.0.5 (SPSS Inc., Chicago, Illinois). When comparing categorical variables, the Chi-square test was employed. For the comparison of continuous parameters versus categorical groups, the Mann-Whitney test was used if there were 2 groups and the Kruskal-Wallis test was carried out if there were more than 2 groups. Spearman's rank correlation was used to assess associations between continuous variables and asthma knowledge scores. A p -value of < 0.05 was considered to be statistically significant.

Based on the results from univariate analyses, multiple linear regression analysis with a stepwise variable selection method was performed to identify cofactors that were independently associated with asthma knowledge scores. Variables that were significantly associated with asthma knowledge scores in the initial analyses were allowed to enter the stepwise model. The criteria for variable entry and exit for the stepwise selection process were based on $p < 0.05$ and $p > 0.10$, respectively.

RESULTS

Patient characteristics

A total of 94 subjects consented to participate in this survey. Four subjects declined participation, citing lack of interest as the reason. The demographics and clinical characteristics of the study subjects are summarized in Table 1. By the one sample Chi-square test, there were proportionately more Indians in our study compared to the racial distribution of the 3 major

Table 1 Demographics and clinical characteristics of study subjects (n = 94)

Variable	Statistics/ subgroups	Data
Age (years)	Range	14 – 78
	Mean	46.4
	Median	48
	Standard deviation	17.7
Gender	Male	51 (54.3%)
	Female	43 (45.7%)
Race	Chinese	66 (70.2%)
	Malay	9 (9.6%)
	Indian	18 (19.1%)
	Others	1 (1.1%)
Highest education level	None	19 (20.2%)
	Primary	18 (19.1%)
	Secondary	41 (43.6%)
	Tertiary	16 (17%)
Housing type	1,2,3- room HDB*	32 (34%)
	4,5- room HDB*	56 (59.6%)
	Private**	6 (6.4%)
Duration of asthma (years)	Range	1-60
	Mean	18.5
	Median	15.0
	Standard deviation	14.1
Smoking status	Non smoker	69 (73.4%)
	Ex smoker	16 (17.0%)
	Current smoker	9 (9.6%)
ACEC attendance***	Never	54 (57.4)
	Ever	40 (42.6)

Data are presented as number or number (%), unless otherwise stated.

*HDB: Housing Development Board (Public housing)

**Private housing includes private apartments, condominiums or landed property

***ACEC: Asthma Clinic and Education Centre

ethnic groups (Chinese, Malays and Indians) in Singapore ($p < 0.0005$). Of the subjects, 60.6% had received at least secondary education.

Sources of asthma information

Fig. 1 summarizes the responses to Question 1, while Fig. 2 summarizes the responses to Question 2. Most of the subjects (83.0%) named the doctor as a source of information on asthma (Fig. 1). Nine

subjects (9.6%) cited self-experience as their source of information, while 6 (6.4%) reported that they had no source of information on asthma. Those who had no source of information were significantly older ($p = 0.04$), had suffered from asthma for a shorter duration ($p = 0.009$) and had lower educational level ($p = 0.022$). We also observed significantly higher educational levels among those who had gained asthma information from pamphlets, news-

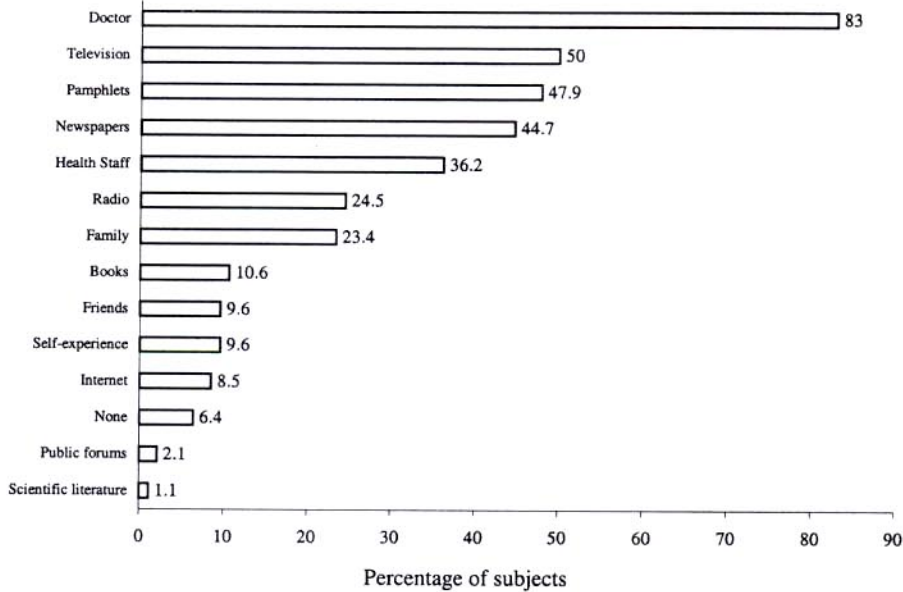


Fig. 1 Sources of asthma information.

papers, books and internet compared to those who did not ($p < 0.0005$, $p = 0.003$, $p = 0.014$ and $p = 0.015$, respectively).

When asked to name the one source from which they had learnt the most about asthma, fewer than half (45.7%) cited their doctors as their main source of information (Fig. 2). Eighteen (19.1%) subjects denied a main source of information.

Knowledge of asthma and asthma medications

Although the majority of the subjects responded correctly to the three knowledge statements of the basic underlying mechanism of asthma, 39.4% of the subjects were ignorant of the inflammatory nature of asthma (Table 2). All 94 subjects were on reliever medications while 90 (95.7%) subjects were on preventer medications as well. The majority of subjects (92.6%) correctly identi-

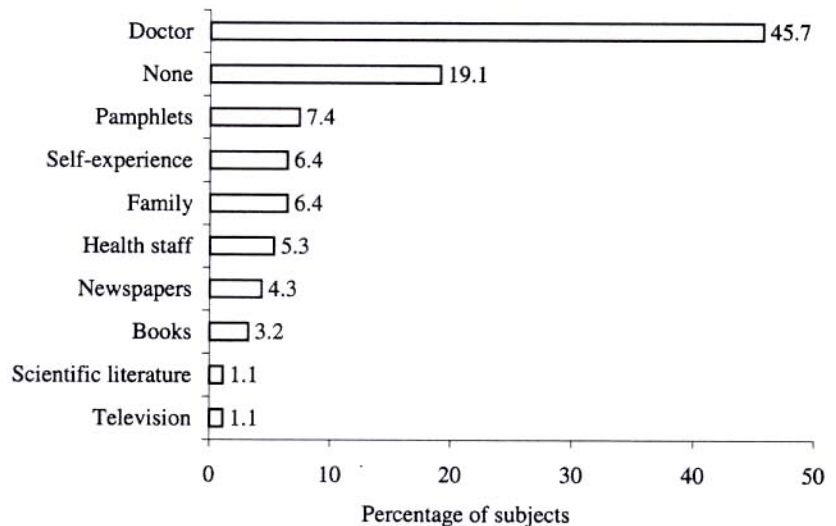


Fig. 2 Main source of asthma information for patients.

fied "reliever" medications as those to be taken during occurrence of acute asthma symptoms. Similarly, 93.3% of those prescribed "preventer" medications correctly identified these as medications to be

taken on a regular basis. Less than half of the subjects (43.6%) were aware of the role of a short course of prednisolone that was prescribed to them, while the remainder responded that they did not know.

For analyses of the asthma knowledge scores, to maintain consistency, the 4 subjects who were not prescribed preventer medications were excluded, as they had a total possible score of 5 instead of 6. Analyses on the asthma knowledge scores were performed on the remaining 90 subjects. Cronbach's alpha reliability for the 6-item knowledge scale was 0.58.

Overall, the median asthma knowledge score was 5.0. Lower educational level was significantly associated with lower knowledge scores (Table 3). We also observed that older age was significantly correlated with lower knowledge scores (Spearman's rank correlation = -0.281, $p = 0.007$). No correlation was found between the duration of asthma and asthma knowledge scores ($p = 0.355$). Asthma knowledge scores were significantly higher among those who named the doctor, pamphlets, newspapers, internet and books as a source of asthma information, compared to those who did not (Table 4). Multiple linear regression analysis with stepwise variable selection method revealed that educational level and having doctor and newspapers as a source of asthma information were independently associated with asthma knowledge scores, after adjusting for other confounders (Table 5).

Written asthma action plan ownership

Only 17.0% of subjects reported having a written action plan to guide them when they suffered from an asthma attack. The majority (67%) responded in the negative and 15 (16%) were not sure if they had received one. Those who had ever attended the ACEC were more

Table 2 Knowledge of the mechanism of asthma

Statement	Number (%)
Asthma is due to narrowing of airways	
- Yes	74 (79.8%)
- No	5 (5.3%)
- Don't know	14 (14.9%)
Asthma is due to swelling/inflammation of the airways	
- Yes	57 (60.6%)
- No	14 (14.9%)
- Don't know	23 (24.5%)
Asthma is due to allergens in the environment	
- Yes	81 (86.2%)
- No	8 (8.5%)
- Don't know	5 (5.3%)

likely to have been advised of a written action plan than those who had not ($p = 0.02$).

DISCUSSION

Of the 94 subjects in our survey, 39.4% were ignorant of the inflammatory nature of asthma while 56.4% did not understand the role of prednisolone in acute exacerbation of asthma. Only 17.0% reported having a written asthma action plan. Our audit demonstrates that in this era of clinical guidelines, a large number of asthmatics still have poor understanding of some aspects of their disease and have no written asthma action plan. We also found that educational level and having doctors and newspapers as a source of asthma information were significant independent predictors of asthma knowledge scores, after adjusting for confounders.

Greater proportions of subjects were aware of the basic mechanisms of asthma as compared to the

SAAMS in 1993. Subjects understood the roles of their medications. Ninety-three percent used their preventer medications on a regular basis, as compared to the SAAMS, in which only 37% used their preventer medications as prescribed. Of concern is that the majority (56.4%) did not understand the role of prednisolone in acute exacerbations of asthma.

We found that the doctor was the main source of asthma information. Our study suggests that subjects look up to doctors as an important source of information on asthma, therefore clinicians should continue to play an important role in disseminating information on asthma. In particular, they should reach out to lowly educated patients, as this group was associated with poorer asthma knowledge. Traditional patient education relies heavily on printed materials that are often poorly understood by lowly educated patients. Failure to tailor educational efforts to this group of

patients may explain why current asthma education programs may not always improve outcomes. Of concern is that some subjects reported to have no source of information. Possible reasons for this include lack of awareness of asthma resources or lack of communication between patients and health care professionals.

The small proportion of the subjects who reported having a written action plan reflects the situation in most other studies.¹⁴⁻¹⁶ This is despite numerous clinical practice guidelines on asthma which emphasize the importance of written asthma action plans and highlights the gap between current guideline recommendations and current practice in the real world. This may reflect a lack of compliance with the recommendations of clinical practice guidelines.¹⁵

In our local population, the Chinese constitute 76.8%, Malays 13.9%, and Indians 7.9%.¹⁷ The Indians in our study made up 19.1% of the total, and this could be attributed to the higher prevalence of asthma in this ethnic group, as compared to Malays or Chinese.¹ Although Malays also have a high prevalence of asthma, they are under-represented in this study. This could be due to the Malay asthmatics making less use of health services than Indians or Chinese, as suggested in a recent paper.¹³

Even though smoking is a known asthma trigger, 10% of subjects were current smokers. This is comparable to the national statistics, which showed that 15% of persons aged 18-64 years were daily smokers.¹⁸ Factors such as psychological addiction, lack of emphasis on

Table 3 Asthma knowledge scores by demographic characteristics

Variable	Median	Range	p-value
Overall	5.0	1-6	
Gender			0.785
- Male	5.0	1-6	
- Female	5.0	1-6	
Race			0.550
- Chinese	5.0	1-6	
- Malay	5.0	3-6	
- Indian	5.0	2-6	
Education			0.002
- No formal education	4.0	1-6	
- Primary education	4.5	1-6	
- Secondary education	5.0	2-6	
- Tertiary education	6.0	2-6	
Housing Type			0.076
- 1,2,3- room HDB*	4.0	1-6	
- 4,5 room HDB*	5.0	1-6	
- Private	5.5	4-6	
Smoking status			0.797
- Non smoker	5.0	1-6	
- Ex smoker	5.0	2-6	
- Current smoker	5.0	2-6	
ACEC attendance**			0.112
- Never	5.0	1-6	
- Ever	5.0	1-6	

*HDB: Housing Development Board (Public housing)

**ACEC: Asthma Clinic and Education Centre

smoking cessation in asthma management, lack of self-efficacy or skills may have influenced their behaviour. Asthma care providers and asthma educators should be aware of these factors and help smokers discover their motivation to stop smoking and develop the relevant skills to effect a beneficial behaviour change.

Although in this study we did not classify the subjects as mild,

moderate or severe asthmatics, an indication of the severity of asthma could be inferred from the medication they were taking. As noted, 95.7% of the subjects were on preventer medication, which implied that they had persistent asthma.

In this study, we measured patient's knowledge of asthma using a simple to administer 6-item test, which was constructed based on recommendations of current asthma

Table 4 Asthma knowledge scores by sources of asthma information

Sources of information	Knowledge scores of subjects without source present*	Knowledge scores of subjects with source present*	p-value
Doctor	4 (1-6)	5 (1-6)	0.001
Health staff	5 (1-6)	5 (1-6)	0.586
Family	5 (1-6)	5 (3-6)	0.153
Friends	5 (1-6)	5 (4-6)	0.455
Pamphlets	4 (1-6)	5 (1-6)	< 0.0005
Newspapers	5 (1-6)	5 (3-6)	0.003
Television	5 (1-6)	5 (1-6)	0.634
Radio	5 (1-6)	5 (3-6)	0.181
Internet	5 (1-6)	6 (4-6)	0.006
Books	5 (1-6)	6 (4-6)	0.010
Self experience	5 (1-6)	6 (3-6)	0.522

*Data are presented as median (range)

Table 5 Independent effect of factors increasing asthma knowledge scores in multivariate analysis

Independent variable	Coefficient	95% CI	p-value
Educational level	0.40	0.15-0.64	0.002
Doctor as source of asthma information	0.93	0.30-1.56	0.004
Newspapers as source of asthma information	0.61	0.13-1.10	0.014

guidelines and evolved from items tested and validated in the SAAMS. It has been shown that patients with limited reading skills have poorer asthma knowledge and self-management skills.¹⁹ Less literate subjects may not be able to read the questionnaire, hence, we overcame this by having an interviewer administer the questionnaire orally and directly evaluate their responses. Asthma knowledge scores developed by other investigators^{20,21} have not been validated in our local context.

Our study has several limitations. As our study was undertaken at only one tertiary care hospital, our findings may not be generalized to other tertiary care centers, either

in Singapore or other neighbouring Asian countries. There is also the potential for selection bias, interviewer bias and subject recall bias.

In conclusion, our study demonstrates that since the advent of clinical practice guidelines, a large number of asthmatics in the tertiary care setting still have poor understanding of some aspects of their disease and have no written plan of action. Low educational level is a barrier to asthma knowledge. Asthma education strategies, targeting the lowly educated and designed to meet their specific needs and effect a positive behavioural change are needed to achieve the goals of asthma programs.

ACKNOWLEDGEMENTS

The authors acknowledge the assistance of Ms. Stephanie Fook Chong in providing statistical advice. The authors also wish to thank all clinical staff of the Department of Respiratory and Critical Care Medicine, Singapore General Hospital.

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APPENDIX

Asthma Clinic and Education Centre (ACEC): The ACEC, which has been established in our hospital since March 1993, involves a multidisciplinary team of respiratory physicians, pharmacists, respiratory technicians and nurses participating in the management and educational counselling of patients over 2 to 3 outpatient sessions. The ACEC aims to help asthmatic outpatients achieve a better understanding of their condition through a structured education program and to review and optimize their asthma treatment and care. At the ACEC, specific emphasis is placed on the inflammatory nature of asthma, roles of reliever and preventer medications, correct inhaler technique, importance of compliance with treatment and asthma self-management skills. Printed asthma educational materials are also routinely given to the patients attending the ACEC. Patients who had never attended the ACEC were managed and educated by their respective physicians and were not exposed to the structured education program.

Questionnaire

- 1) Where did you get your information on asthma? (Tick all that applies)

<input type="checkbox"/> Doctor	<input type="checkbox"/> Friends & peers	<input type="checkbox"/> TV
<input type="checkbox"/> Other health staff (nurses, pharmacists)	<input type="checkbox"/> Pamphlets & handouts	<input type="checkbox"/> Radio
<input type="checkbox"/> Family	<input type="checkbox"/> Newspapers	<input type="checkbox"/> Internet
<input type="checkbox"/> Others (please specify) _____		
- 2) Who has taught you the MOST about asthma? (Tick ONE only)

<input type="checkbox"/> Doctor	<input type="checkbox"/> Friends & peers	<input type="checkbox"/> TV
<input type="checkbox"/> Other health staff (nurses, pharmacists)	<input type="checkbox"/> Pamphlets & handouts	<input type="checkbox"/> Radio
<input type="checkbox"/> Family	<input type="checkbox"/> Newspapers	<input type="checkbox"/> Internet
<input type="checkbox"/> Others (please specify) _____		
- 3) Asthma is due to narrowing of airways.

<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Don't know
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- 4) Asthma is due to swelling/inflammation of the airways.

<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Don't know
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- 5) Asthma is caused by allergens in the environment (e.g. smoke, house dust mite droppings, pollen.)

<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Don't know
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- 6) What medications are you currently taking for your asthma?

(i) _____

When do you take this medication?

<input type="checkbox"/> When I have an attack of asthma
<input type="checkbox"/> I take this medication regularly (i.e. everyday)
<input type="checkbox"/> Don't know

(ii) _____

When do you take this medication?

<input type="checkbox"/> When I have an attack of asthma
<input type="checkbox"/> I take this medication regularly (i.e. everyday)
<input type="checkbox"/> Don't know
- 7) When do you take a short course (few days) of prednisolone that is prescribed by your doctor for asthma?

<input type="checkbox"/> During an attack of asthma or during worsening asthma symptoms
<input type="checkbox"/> Upon recovery from an attack
<input type="checkbox"/> Don't know
- 8) Has any member of the health staff discussed with you a written action plan to guide you when you suffer from an asthma attack?

<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Don't know
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