

Was it Easy to Use an Asthma Control Test (ACT) in Different Clinical Practice Settings in a Tertiary Hospital in Singapore?

Lathy Prabhakaran,¹ MSN, BHS (Nursing), RN, Arul Earnest,² MSC, John Abisheganaden,³ FAMS, MRCP (UK), MMed (Int Med), Jane Chee¹ BHS (Nursing), RN

Abstract

Introduction: The Asthma Control Test™ (ACT) is a 5-item self-administered tool designed to assess asthma control. It is said to be simple, easy and can be administered quickly by patients in the clinical practice setting. This stated benefit has yet to be demonstrated in our local clinical practice setting. The aim was to identify factors associated with difficulty in the administration of the ACT in different clinical practice settings in a tertiary hospital in Singapore. **Materials and Methods:** This is a prospective study performed from April to June 2008. All patients diagnosed with asthma and referred to an asthma nurse from the in-patient and out-patient clinical practice setting in Tan Tock Seng Hospital were enrolled. **Results:** Four hundred and thirty-four patients were asked to complete the ACT tool. In the univariate model, we found that age, clinical setting and medical history to be significantly associated with the completion of the ACT. The odds of completion decreased by a factor of 0.92 (95% CI, 0.89 to 0.94) for every year's increase in age, and this was statistically significant ($P < 0.001$). Similarly, the odds ratio of completion for those with more than 3 medical conditions by history were 0.59 (95% CI, 0.48 to 0.71) as compared to those with less than 3 medical conditions by history, and this was also significant ($P < 0.001$). In the multivariate model, we only found age to be an independent and significant factor. After adjusting for age, none of the other variables initially significant in the univariate model remained significant. **Conclusion:** The results show that the ACT was simple and easy to be administered in younger-aged patients.

Ann Acad Med Singapore 2009;38:1064-9

Key words: Administer, Guidelines, Interpretation, Questionnaire

Introduction

In Singapore, asthma is a very common problem. It is estimated that 140,000 individuals in Singapore have current asthma, with a prevalence as high as 20% among school children,¹ and 5% among the adult population.² The increasing trend in the prevalence of asthma and its personal and societal tolls continue not only in Singapore but internationally.³ This is despite the advances in knowledge about the pathophysiology of asthma and the availability of effective therapy. Current asthma guidelines have shifted their focus from managing acute attacks to achieving and maintaining asthma control for prolonged periods.³ It has been stated that inadequate assessment of asthma control is an important contributing factor for poor asthma control.⁴ While validated tools have been developed previously to

assess and quantify asthma controls, such as asthma control questionnaire (ACQ),⁵ asthma control scoring systems⁶ and asthma therapy assessment questionnaire (ATAQ),⁷ they have various limitations in terms of their clinical usage like complicated scoring, difficulty in interpretation, validated in certain populations only, requires lung function testing that may be expensive and impractical for a typical clinical setting.⁸ To facilitate the assessment of asthma control in a busy clinical practice setting, we needed a tool that is easily and quickly administered and interpreted by patients and clinicians. The Asthma Control Test (ACT) was developed to meet these needs.⁸ It has been cited in GINA³ as having “the potential to improve the assessment of asthma control, providing a reproducible objective measure that may be charted over time and representing an improvement

¹ Nursing Service, Tan Tock Seng Hospital, Singapore

² Clinical Research Unit, Tan Tock Seng Hospital, Singapore

³ Department of Respiratory Medicine, Tan Tock Seng Hospital, Singapore

Address for Correspondence: Lathy Prabhakaran, Department of Nursing, Tan Tock Seng Hospital, 11 Jalan Tan Tock Seng, Singapore 308433

Email: lathy_prabhakaran@tts.com.sg

in communication between patient and healthcare professional". The ACT is a 5-item self-administered tool that is stated to be simple, easy and can be quickly administered by patients in different clinical settings. The stated benefits have yet to be demonstrated in our setting with Singapore being a multi-racial, multi-ethnic nation. The aim of this study was to assess if the ACT was easy to use in a tertiary hospital in Singapore. This study aimed to identify factors associated with difficulty in administering the ACT in 2 clinical practice settings.

Materials and Methods

Study Subjects

This is a prospective study performed from 1 April 2008 to 30 June 2008. All patients with a clinical primary diagnosis of asthma and referred to the asthma nurse by physicians from the in-patient and out-patient clinical practice settings in Tan Tock Seng Hospital were enrolled in this study. Patients who were smokers were not excluded and the duration of asthma symptoms and spirometry results were not captured in this study.

Study Design

Asthma Control Test™ (ACT) Questionnaire (Appendix 1)

The ACT is a 5-item questionnaire that assesses interference with activity, shortness of breath, nocturnal symptoms, rescue medication use and self-rating of asthma control.⁸ The asthma control test has been translated into different languages and used internationally. In Singapore, the ACT is available in English, Mandarin and Malay languages. During the consultation, the patients were allowed to choose the language of the ACT. The patients were asked to complete the ACT during a consultation session with an asthma nurse. They self-administer the ACT in the presence of the asthma nurse who was there to assist. They were allowed to ask for clarification if they could not understand the questions or ask for assistance to complete the ACT questionnaire.

Survey questionnaire

The survey questionnaire consisted of demographics, including age, sex and race, clinical settings and other medical history. We assessed whether patients needed assistance, if the ACT was easy to use and understand, and whether all questions were completed. All patients with a clinical diagnosis of asthma and referred to an asthma nurse by physicians from the in-patient and out-patient clinical practice settings in Tan Tock Seng Hospital were enrolled in this study.

Statistical analysis

The main outcome measure was completion of the ACT,

which was measured as a dichotomous variable (yes/no). The binary logistic regression model was used to study factors associated with the completion of the ACT. Both univariate and multivariate analyses were performed. Starting from the most significant variable identified in the univariate analysis, the likelihood ratio test was used to determine whether inclusion of a new covariate improved the fit of the model. The crude and adjusted odds ratios were presented as measures of effect size, along with their associated 95% confidence intervals. In addition, the chi-square test was used to examine bivariate relationships between categorical variables, and the independent Student's *t*-test to examine the mean age between those who needed translation and those who did not. Data analysis was performed in Stata V9.2 (Stata Corp, College Station, Tx, USA) and the level of significance was set at 5%.

Results

A total of 434 patients were enrolled in the study. The demographics of the study population are shown in Table 1. Two hundred and forty-two patients (55.8%) were male. In terms of ethnicity, 54.4% were Chinese, followed by 24.9% Indians, 18.9% Malays and 1.8% of other races. The mean age of respondents was 50.3 years (SD, 17.1) with a range of 17 to 93 years. The mean number of medical condition was 1.8 (SD, 1.4) with a range of 1 to 8. Table 2 shows the outcome of the ACT administered in different clinical practice settings. The majority of the patients were

Table 1. Demographic Characteristic of Patients Enrolled in the Study

Characteristic	No. of sample (n = 434)	
	n	%
Sex		
Male	242	55.8
Female	192	44.2
Race		
Chinese	236	54.4
Malay	82	18.9
Indian	108	24.9
Others	8	1.8
Age (y)		
Mean age	50.3 (range 17-93)	SD 17.1
≤50	191	44
≥50	243	56
Other medical condition		
Mean no. of medical condition	1.8 (range 1-8)	SD 1.4
≤than 3 medical conditions	343	79
≥than 3 medical conditions	91	21

follow-up cases at the out-patient asthma specialist clinic setting (56%). The percentage of new patients visiting the out-patient asthma specialist setting for the first time was 20%, while 24% were from the in-patient setting. Out of 434 patients, 399 (92 %) completed all 5 ACT questions and 76% found it easy to understand. Seventy-five per cent were able to self-administer the ACT. The reasons for not completing and the reasons given for the ACT not being easily understood are shown in Tables 3 and 4. The main language used for the ACT was English (73%) followed by Mandarin (21%) and Malay (6%). Ninety-one patients (21%) requested the ACT to be translated. The reasons for translations were that of being illiterate (73%) and poor eye sight (27%). We also found that those who needed translation were older compared to those who did not (mean age, 67 vs 48 years) and this difference was statistically significant ($P < 0.001$).

Table 5 shows the ACT languages used by different races in Singapore. Eighty-eight out of 108 (81.5%) Indians used

the English version of the ACT compared to 120 out of 236 (50.8%) Chinese and 54 out of 82 (65.8%) Malays used the English version.

In terms of factors associated with the completion of the ACT, in the univariate model, we found that age, clinical setting and co-morbid medical history to be significantly associated with the outcome (Table 6). For instance, the odds of completion decreased by a factor of 0.92 (95% CI: 0.89 to 0.94) for every year's increase in age, and this was statistically significant ($P < 0.001$). Similarly, the odds ratio of completion for those with more than 3 medical conditions was 0.59 (95% CI, 0.48 to 0.71) as compared to those with less than 3 medical conditions, and this was also significant ($P < 0.001$). In-patients were less likely than out-patients (new cases) to complete the ACT (Table 6). In the multivariate model (Table 7), we only found age to be an independent and significant factor. After adjusting for age, none of the other variables initially significant in the univariate model remained significant.

Discussion

The primary diagnosis of our study population was asthma, but many subjects had other secondary medical problems which is what we find in a real world setting. Patients who were smokers were not excluded and the duration of asthma symptoms and spirometry results were not captured in this study. The primary diagnosis is confirmed by the clinician from clinical symptoms with or without spirometric evaluation. Regular follow-up spirometry is available in our clinical settings only with an appointment and it is costly to be done at each clinical visit. If current recommendations encourage defining asthma control using simple validated tools,³ it will be useful if we have tools that can assess valid

Table 2. Outcome of ACT Administration in Different Clinical Practice Setting

Variable	No. of sample (n = 434)	
	n	%
Type of clinical practice settings		
Out-patient setting (New patient visiting the asthma specialist for the first time)	87	20
Out-patient setting (Follow-up cases)	243	56
In-patient setting	104	24
Completed ACT questionnaire		
No	35	8
Yes	399	92
Mode of administration of ACT		
Self	326	75
Need assistance	108	25
ACT was easy to understand		
No	102	24
Yes	332	76
ACT language used (n = 371)		
English	270	73
Mandarin	77	21
Malay	24	6
Request for translation (n = 91)	91	21
Reasons for translation		
Illiteracy	66	73
Poor eyesight	25	27

Table 3. Reasons for not Completing the ACT Questionnaire

Reason	n = 35
Unable to comprehend	28
Do not want to do the ACT	3
Incomplete, newly diagnosed not sure of Q4 and Q5	2
Poor historian	1
Too ill	1

Table 4. Reasons Given for ACT not Being Easy to Understand

About the ACT questions: Feel lost to some questions, uncertain, don't understand, some question confusing, some questions ambiguous and not concise

About the ACT answer: Answers were not clear, confusing, not simple, don't fit in their condition, misleading Question 2, answer has no month frequency, takes long time

Using wrong Mandarin words for the Mandarin translated ACT-Q2

Table 5. ACT Language Used by Different Races in Singapore

Race	No. of subjects enrolled (n = 434)		English ACT		Mandarin ACT		Malay ACT	
	n	%	n	%	n	%	n	%
Chinese	236	54.4	120	50.8	77	32.6	0	0
Malay	82	18.9	54	65.8	0	0	23	28
Indian	108	24.9	88	81.5	0	0	1	1
Others	8	1.8	8	100	0	0	0	0

Chi-square test $P < 0.001$

Table 6. Univariate Factors Associated with Completion of the ACT

Variable	Odds ratio	P
Sex		
Male	1	
Female	1.8 (0.86-3.8)	0.116
Race		
Chinese	1	
Malay	0.98 (0.37-2.6)	0.973
Indian	0.62(0.29-1.4)	0.229
Age	0.92 (0.89-0.94)	< 0.001
Clinical setting		
Outpatient setting (new cases)	1	
Outpatient setting (follow-up cases)	1.93 (0.66-5.58)	0.227
Inpatient setting	0.31 (0.12-0.81)	<0.017
>Medical condition	0.59 (0.48-0.71)	<0.001

measures of asthma control that does not require spirometry. The developers of the ACT have stated that the ACT can be used as an independent measure of asthma control in clinical settings without access to a spirometer.⁸ Thus in most of our clinical practice settings in Singapore, we are currently using the ACT to assess asthma control. The majority of these patients with asthma are managed by a range of healthcare professionals, in brief consultations.

This study examines for the first time (to the best of our knowledge) the real world practicability in using the ACT in different clinical settings and among various ethnically diverse populations. It has been stated that the ACT is easy, can be done quickly, scored and interpreted easily by both patients and clinicians. The stated benefit has yet to be demonstrated in our clinical practice setting.

The main purpose of this study was to identify factors associated with the difficulty in the administration of the ACT at both in-patient and out-patient settings (follow-up and new patients).

In terms of ethnicity, previous population-based studies have documented that in multi-ethnic Singapore, the

Table 7. Multivariate Factors Associated with Completion of the ACT

Variable	Adjusted odds	P
Age	0.92 (0.89-0.94)	<0.001

prevalence of current asthma in Malays (3.3%) and Indians (4.5%) is higher than that in Chinese (0.9%).⁹ However the ethnic mix of our study population was significantly skewed towards the majority population of Chinese (54.4%). This is expected as our local population is predominantly Chinese (75.2% Chinese, 13.6% Malays, 8.8% Indians and 2.4% Others). In Singapore, we have 4 official languages: English, Malay, Mandarin and Tamil. Despite Malay being the national language of the country, the language used to complete the ACT by the vast majority was English (73%). There was a significant difference in the language of the ACT used by the Indians ($P < 0.001$, Table 4) and this might be because there was no Tamil translation of the ACT. Furthermore, this should come as no surprise as English serves as a link between the different ethnic groups and it is the language of the educational system and the administration.

A total of 92% (399) completed the ACT questionnaire but 23.5% (102) of patients claimed that the ACT was not that simple to use. The reasons for not completing the ACT and the reasons given for the ACT not being easily understood are shown in Tables 3 and 4. To illustrate further on some reasons given, for question 1 on the limitation of daily activities caused by asthma, some patients informed they did not work, did not do any housework or any significant activity, so they were unsure how to answer the question. For question 2 on the assessment of shortness of breath, some of the patients' answers did not fit their symptoms and the month of duration was not specified. For question 4 regarding the use of a rescue inhaler (salbutamol) or nebuliser, some patients did not know what was being referred to or they mistook it as the use of preventors/controllers. At the same time, some patients had been using a rescue inhaler regularly as a "precaution" measure instead of "on demand". On the other hand, we had newly diagnosed asthmatics who were unable to answer questions 2 and 4 as they were not

on rescue inhalers to relieve their symptoms and did not recognise their asthma symptoms. These explained the lack of comprehension regarding the use of rescue inhalers and may also account for the reported confusion regarding symptoms. For question 5 on self-rating of their control of asthma, patients tended to claim that with the use of rescue inhalers, they could control their asthma and therefore they rated their asthma as adequately or well-controlled. These findings are in keeping with other studies that indicated that many asthmatic patients were undertreated because they overestimated their degree of control of asthma.¹⁰⁻¹²

In terms of the translated version, some patients claimed the Mandarin words used in the ACT were inaccurate. Our findings are similar to Zhou et al's study as reported by Sun¹³ that the terminology used to describe respiratory sensation was sometimes unclear. Thus, Sun¹³ cautioned to adapt an assessment tool to a second language, and its metric properties should be tested in the specified population for validity of the ACT. Given the above restrictions, the healthcare professionals have to be cautious when interpreting the self-administered ACT especially for patients who are illiterate, poor historians and doing it for the first time. Despite restricted physician-patient interaction time, they have to clarify with the patients who self-administer the ACT or the caregiver to ensure it is indeed an accurate and reliable tool for the assessment of asthma control. Furthermore, it has been stated that using the ACT may improve communication between patients and physicians. By clarifying with the patient, it would further improve physicians' performance, patient's satisfaction and therapeutic outcomes.^{14,15}

The median age of our study population was 50.3 years. A majority of the patients was more than 50 years of age (56%) compared to patients previously studied in the development (mean age, 45 years)⁸ or longitudinal validation (mean age, 35 years) studies.¹⁶ In the analysis in the univariate and multivariate model, we found age to be significantly associated with the completion of the ACT. In this study, we did not look at the educational level of patients. We suspect the other reason for not completing the ACT other than that shown in Table 7 was these patients were illiterate. Zhou et al¹⁷ in their study stated that patient knowledge about asthma may influence the accuracy of the ACT, and that patients should be further educated about asthma to enhance the accuracy of the ACT. The ACT cannot be used for patients who do not comprehend the questions or who are poor historians. It will be important for future studies to assess the educational attainment for which the degree of completion of the ACT tool will depend. We wanted to know if having more common chronic comorbid conditions had an impact on the ability to fill out the ACT. Thus, we found in the univariate model patients with more than 3 medical conditions by history were less likely to complete

the ACT as compared to those with less than 3 medical conditions by history ($P < 0.001$). Stephen's study¹⁸ also found that certain demographic and comorbidities were independently associated with uncontrolled disease, including gastroesophageal reflux disease, chronic sinusitis and high blood pressure. Comorbid conditions that can trigger asthma need to be assessed and addressed for controlling asthma.

The limitation of this study is that by including patients with comorbid conditions, it can be difficult for patients to understand the comprehensive nature of many illnesses and differentiate their signs and symptoms from asthma. However in the multivariate analysis after accounting for age, clinical setting and medical conditions by history were no longer statistically significant. This indicates that the difference between the in-patients and out-patients seen in the univariate analysis could be attributed to differences in age distribution.

A potential limitation of this study is that spirometry measurements were not obtained to confirm the diagnosis of asthma for some patients as they were not routinely ordered. If epidemiologic studies identify physician-diagnosed asthma as a valid way to identify patients with asthma, then it should not matter too much whether spirometry was used for this study.¹⁹

Conclusion

In conclusion, this study confirmed that the ACT questionnaire, a clinically validated measure of asthma control is simple, easy to use and can be quickly administered for younger patients. However, it may pose a challenge to older patients who may be illiterate, poor historians and unable to comprehend the 5 ACT questions. We anticipate that this tool will play an important role in our ongoing efforts to evaluate and optimise long-term asthma control in patients with asthma. We encourage the use of this validated control tool in all clinical settings to identify inadequately controlled asthma that needs additional intervention.

Acknowledgements

The authors like to thank Ms Syahidah Salleh, 2nd year nursing student from Ngee Ann Polytechnic School of Health Sciences, for her assistance in data entry for this study.

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Asthma Control Test™ (ACT) Questionnaire (Appendix 1)

	Score
<p>1. In the past 4 weeks, how much of the time did your asthma keep you from getting as much done at work, school or at home?</p> <p style="text-align: center;"> All of the time 1 Most of the time 2 Some of the time 3 A little of the time 4 None of the time 5 </p>	<input style="width: 30px; height: 20px;" type="text"/>
<p>2. During the past 4 weeks, how often have you had shortness of breath?</p> <p style="text-align: center;"> More than once a day 1 Once a day 2 3 to 6 times a week 3 Once or twice a week 4 Not at all 5 </p>	<input style="width: 30px; height: 20px;" type="text"/>
<p>3. During the past 4 weeks, how often did your asthma symptoms (wheezing, coughing, shortness of breath, chest tightness or pain) wake you up at night, or earlier than usual in the morning?</p> <p style="text-align: center;"> 4 or more nights a week 1 2 or 3 nights a week 2 Once a week 3 Once or twice 4 Not at all 5 </p>	<input style="width: 30px; height: 20px;" type="text"/>
<p>4. During the past 4 weeks, how often have you used your rescue inhaler or nebulizer medication (such as albuterol)?</p> <p style="text-align: center;"> 3 or more times per day 1 1 or 2 times per day 2 2 or 3 times per week 3 Once a week or less 4 Not at all 5 </p>	<input style="width: 30px; height: 20px;" type="text"/>
<p>5. How would you rate your asthma control during the past 4 weeks?</p> <p style="text-align: center;"> Not controlled at all 1 Poorly controlled 2 Somewhat controlled 3 Well controlled 4 Completely controlled 5 </p>	<input style="width: 30px; height: 20px;" type="text"/>
<p><small>Copyright 2002, QualityMetric Incorporated. Asthma Control Test is a Trademark of QualityMetric Incorporated.</small></p>	<input style="width: 30px; height: 20px;" type="text"/>
Patient Total Score	<input style="width: 30px; height: 20px;" type="text"/>