Original Article

Difference in Asthma Control Test™ (ACT) Scores in Three Different Clinical Practice Settings

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Abstract

Introduction: Asthma control varies in different clinical settings because of its multidimensional and heterogeneous nature, and variability over time. The revised asthma management guidelines indicate that the goal of treatment should be maintaining asthma control for long periods. The aims of this study were to explore: (i) difference in asthma control test scores in patients at different clinical practice settings; (ii) assess if patients were overestimating the level of their asthma control and (iii) assess the relationship of the derived Asthma Control Test (ACT) score to cost of inpatient stay and length of stay (LOS). **Materials and Methods:** The Asthma Control Test (ACT) is a 5-item questionnaire that assesses the multidimensional perspective of asthma control from activity limitation, shortness of breath, night symptoms, use of rescue medication and self perception of asthma control. The score ranges on a scale from 1 (poorly controlled) to 5 (well controlled). ACT was administered to 447 patients diagnosed with asthma from the in-patient and out-patient settings (new and follow-up cases). **Results:** Three hundred and ninety-nine (92%) patients completed the ACT questionnaire. The analysis only included patients who had completed the ACT questionnaire. The analysis showed that all the 5 items in the ACT questionnaire were significantly associated with different clinical settings ($P <0.001$). When we correlated the ACT question 5 (patients self rating of asthma control) in the ACT with Question 3 and Question 4 individually, it showed that most patients did not overestimate their asthma control ($P <0.001$). However, there was no correlation between the derived ACT score and cost ($P = 0.419$), LOS ($P = 0.373$), and the number of comorbid medical history ($P = 0.055$). **Conclusion:** Our results reinforce the usefulness of ACT for clinicians to identify patients with poorly controlled asthma and to optimise their level of control in different clinical settings.

Ann Acad Med Singapore 2010;39:783-89

Key words: Clinical guidelines, Overestimate, Useful

Introduction

The prevalence of asthma ranges from 1% to 18% worldwide[1] and it remains a significant cause of morbidity and economic burden despite advances in its knowledge, detection and treatment. Asthma is very common in Singapore[2,3] and it consumes a considerable amount of healthcare service resources.[4] A local study on asthma control at the polyclinic level showed that more than half of the patients had poorly controlled asthma.[5] This finding is similar to a survey conducted in the United States and inadequate assessment of asthma control appears to be an important contributing factor.[6] The previous global initiative for asthma (GINA) guideline categorised asthma into different levels of disease severity and recommended

ways to manage acute attacks. The latest revised guidelines have shifted their focus from achieving asthma control to maintaining asthma control for prolonged periods.[1] It is also stated in the GINA guidelines that there should be a continuous cycle of assessing asthma control, treating to achieve control and monitoring to maintain control. However, it is difficult to assess asthma control in different clinical practice settings because of its multidimensional and heterogeneous nature and variability over time. It has also been found that physicians mostly use subjective measures as they are unaware of the practice guidelines and the guidelines' recommendations are, many a time, only partially followed.[7] To assess control, we need a tool that is simple, standardised, relevant, and can be quickly

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administered by self and interpreted consistently in different clinical practice settings by both patients and healthcare providers. One such tool that has met these needs is the Asthma Control Test (ACT) developed by Nathan et al.[8] In our previous study, we looked at factors associated with the difficulty in administration of the ACT in different clinical practice settings in a tertiary hospital in Singapore.[9] The results showed that the ACT was simple and easy to be administered in patients of younger age. The purpose of this second study was to characterise the ACT further. The 5-item questionnaire on the multidimensional nature of asthma control was consistent with the asthma management guidelines: impact of asthma on everyday functioning, asthma symptoms and use of rescue medications. We sought to work at the performance of each item in the ACT in assessing asthma control against different clinical practice settings. We hypothesised that the patients in the out-patient (follow-up) group would score higher in all the 5 items than the patients from the outpatient (new) and inpatient groups. Similarly, we hypothesised that when patients are given a tool like the ACT to assess asthma control, they will not overestimate their level of asthma control.

Objectives

This study aimed to explore:

(i) Difference in asthma control test scores in patients at different clinical practice settings.

(ii) Assess if patients were overestimating the level of their asthma control.

(iii)Assess the relationship of the derived ACT score to the cost of inpatient and length of stay (LOS).

Materials and Methods

Study Subjects

This is a prospective study performed from 1 April 2008 to 30 June 2008. All patients with a clinical diagnosis of asthma and were referred to the nurse in charge of asthma patients by physicians in Tan Tock Seng Hospital were enrolled in this study. The patients included all asthma patients from the inpatient and outpatient settings.

Study Design [Asthma Control Test™ (ACT) questionnaire (Fig. 1)]

The patients were asked to complete the ACT and survey questionnaire during the consultation session with the nurse in charge of asthma patients. The ACT is a 5-item questionnaire that assesses interference with daily activities, shortness of breath, nocturnal symptoms, use of rescue medication over the past 4 weeks and self-rating of asthma control on a 5-point scale (Fig. 1). The ACT used the summing of scoring responses to indicate the effectiveness of asthma control. It is user friendly as the patient only needs

Fig. 1. Asthma Control Test™ (ACT) questionnaire.

to add the score that will range from 5 (poor control) to 25 (complete control). This sum of counts method is found to be more practical and time saving. It reduces the time to compute and to interpret the score compared to other tools that quantify asthma control.[8] The asthma control test has been translated into different languages and is used internationally. In Singapore, the ACT is available in English, Mandarin and Malay. During the consultation, patients can choose the preferred language of ACT. Patients are encouraged to self administer the ACT. They may clarify if they do not understand the questions and ask for assistance to complete the ACT questionnaire if necessary. The nurse in charge of asthma patients then completes the survey questionnaire which consists of demographics, including age, sex and race, clinical settings, other medical history, with asthma being the primary diagnosis for enrolment. The study examined the patient's response to the ACT questionnaire at the time of assessment in 3 different clinical practice settings. For the inpatient setting, it also examined length of stay (LOS) and gross cost incurred for the current admission.

Statistical Analysis

We used the chi-square test of association to examine whether clinical setting was statistically associated with each item of the ACT score. We also used the chi-square test to examine whether the items were correlated with each other. We compared the comorbidity group with control of asthma (ACT $\geq$20) using the Fisher's Exact test. For continuous variables such as length of hospital stay and inpatient cost, we used the Mann-Whitney test to examine whether the distributions were equal. Statistical analysis was performed in Stata V9.2 (Stata Corp, College Station, Tx, USA) and all tests were conducted at the 5% level of significance.

Results

Out of 434 patients enrolled in the study, 399 (92%)

Table 1. Demographic of the Samples in Different Clinical Practice Settings

Patients	Out-patient (new) n = 81	Out-patient (follow-up) n = 234	In-patient n = 84
Gender			
Female	38 (46.9%)	133 (56.8%)	47 (55.9%)
Male	43 (53.1%)	101 (43.2%)	37 (44.1%)
Race			
Chinese	46 (56.8%)	141 (60.3%)	32 (38.1%)
Malay	15 (18.5%)	34 (14.5%)	27 (32.1%)
Indian	19 (23.5%)	53 (22.6%)	24 (28.6%)
Others	1 (1.2%)	6 (2.6%)	1 (1.2%)
Mean age, in years (range)	44 (17-81)	51 (20-85)	46 (17-78)
<20	10 (12.4%)	4 (1.7%)	6 (7.1%)
21 - 30	15 (18.5%)	27 (11.5%)	18 (21.4%)
31 - 40	8 (9.9%)	20 (8.6%)	10 (11.9%)
41 - 50	13 (16.1%)	48 (20.5%)	13 (15.5%)
>51	35 (43.2%)	135 (57.7%)	37 (44.1%)
Mean no. of comorbid medical history	1.6	1.5	2.3
≤ 3 comorbid medical history	74 (91.4%)	218 (93.2%)	61 (72.6%)
≥ 3 comorbid medical history	7 (8.6%)	16 (6.8%)	23 (27.4%)

Data are presented as n (%).
All percentages refer to the number in the different clinical practice settings as percentage of column total.

Fig. 2. Composition of the study population.

Fig. 3. The 2 levels of asthma control in different clinical practice settings.

completed the ACT questionnaire. Only patients who completed the ACT questionnaire were included in the analysis. Figure 2 shows the composition of the study population. The demographics of the study population are shown in Table 1. Females were predominantly seen at the outpatient follow-up group (56.8%) and the inpatient group (55.9%). The percentage of Malays, Indians and Chinese at the inpatient setting were 32.1%, 28.6% and 38.1%, respectively. The mean age of respondents in the out-patient follow-up was 51 years (SD 15.2) with a range of 20 to 85 years. They were older in mean age compared to the other two settings. The mean number of comorbid medical history for the inpatient setting was 2.3 (SD1.7). Figure 3 shows the 2 levels of asthma control in different clinical practice settings. The total asthma control score ranged from 5 to 25. The distribution of the level of asthma control score was derived when we use the cut-off point score to separate those patients who were in control of their asthma and those who were not. We selected the cut-off point of 19. A score of 19 and below was considered to be uncontrolled asthma and a score of 20 and above was considered to be controlled asthma.

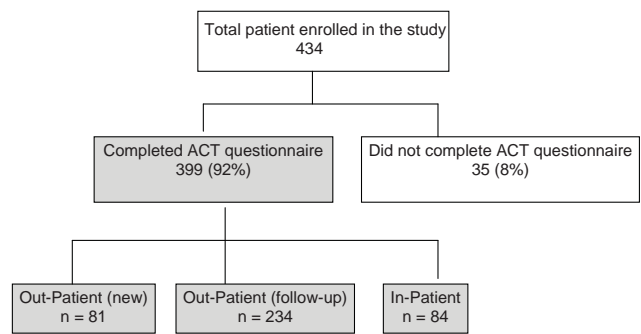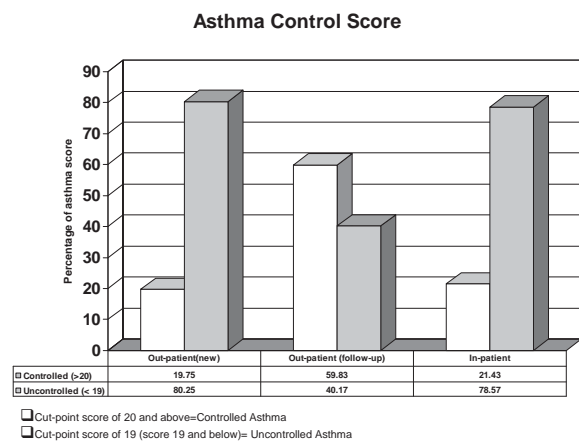Table 2 shows the analysis of asthma control assessed by the 5 items in the ACT across groups in different clinical practice settings.

Question 1 (Restriction of Daily Activities)

It was found that 44.9% of patients in the outpatient follow-up setting stated that there was no restriction at all in activities at work, school or home compared to 17.2% in the outpatient (new) group and 26.2% of patients in the inpatient group (P <0.001).

Question 2 (Shortness of Breath)

On assessment of shortness of breath (SOB) over the past 4 weeks, 42.9% of patients in the inpatient setting complained of SOB once or twice a week compared to 35.8% in the outpatient (new) group and 36.3% of patients in the outpatient (follow-up) group (P <0.001).

Question 3 (Nocturnal Awakenings)

On assessment for nocturnal symptoms over the past 4 weeks, 50% of patients in the outpatient (follow-up) setting had no nocturnal symptoms compared to 18.5% of patients in outpatients (new) group and 11.9% of patients in the inpatients group (P <0.001).

Table 2. Comparison of the 5 Items in the ACT Scores across Groups in Different Clinical Practices Settings

Q1: During the past 4 weeks, how often did your asthma prevent you from getting as much done at work, school or home?						
Clinical setting	1. All of the time	2. Most of the time	3. Some of the time	4. A little of the time	5. None of the time	Total	P
Outpatient (new)	2 (2.5)	15 (18.5)	31 (38.3)	19 (23.5)	14 (17.2)	81	<0.001
Outpatient (follow-up)	2 (0.8)	14 (6)	51 (21.8)	62 (26.5)	105 (44.9)	234	<0.001
Inpatient	2 (2.4)	9 (10.7)	28 (33.3)	23 (27.4)	22 (26.2)	84	<0.001

Q2: During the past 4 weeks, how often have you had shortness of breath?						
Clinical setting	1. More than once a day	2. Once a day	3. 3 to 6 times a week	4. Once or twice a week	5. Not at all	Total	P
Outpatient (new)	13 (16.0)	9 (11.1)	20 (24.7)	29 (35.8)	10 (12.4)	81	<0.001
Outpatient (follow-up)	15 (6.4)	15 (6.4)	21 (9)	85 (36.3)	98 (41.9)	234	<0.001
Inpatient	13 (15.5)	8 (9.5)	16 (19.0)	36 (42.9)	11 (13.10)	84	<0.001

Q3: During the past 4 weeks, how often do your asthma symptoms wake you up at night or earlier in the morning?						
Clinical setting	1. 4 or more times a week	2. 2 to 3 times a week	3. Once a week	4. Once or twice	5. Not at all	Total	P
Outpatient (new)	20 (24.7)	16 (19.8)	7 (8.6)	23 (28.4)	15 (18.5)	81	<0.001
Outpatient (follow-up)	17 (7.3)	25 (10.7)	19 (8.1)	56 (23.9)	117 (50.0)	234	<0.001
Inpatient	14 (16.7)	20 (23.8)	19 (22.6)	21 (25.0)	10 (11.9)	84	<0.001

Q4: During the past 4 weeks, how often have you used your rescue inhaler or nebulizer?						
Clinical setting	1. 3 or more times a day	2. 1 or 2 times a day	3. 2 to 3 times a week	4. Once a week or less	5. Not at all	Total	P
Outpatient (new) 0	15 (18.5)	21 (25.9)	11 (13.6)	15 (18.5)	19 (23.5)	81	<0.001
Outpatient (follow-up) -1	15 (6.4)	30 (12.8)	35 (15.0)	72 (30.8)	82 (35.0)	234	<0.001
Inpatient -2	20 (23.8)	15 (17.9)	18 (21.5)	22 (26.1)	9 (10.7)	84	<0.001

Q5: How would you rate your asthma control during the past 4 weeks?						
Clinical setting	1. Not controlled	2. Poorly controlled	3. Somewhat controlled	4. Well controlled	5. Completely controlled	Total	P
Outpatient (new) 0	5 (6.1)	17 (21)	33 (40.8)	22 (27.1)	4 (5)	81	<0.001
Outpatient (follow-up) -1	6 (2.5)	24 (10.3)	51 (21.8)	114 (48.7)	39 (16.7)	234	<0.001
Inpatient -2	9 (10.7)	15 (17.9)	35 (41.6)	21 (25)	4 (4.8)	84	<0.001

*Data are presented as n (%). All percentages refer to the number in the different clinical practice setting as percentage of row total.

Question 4 (Need for Rescue Medication)

On reviewing the need for rescue medication, 35% of the outpatient follow-up cases did not use rescue medication over the past 4 weeks compared to 23.5% in the outpatients (new) group and 10.7% of patients in inpatients group (P = 0.000).

Question 5 (Self-assessment of Asthma Control by the Patient)

When we looked at the self-rating of asthma control by the patients over the past 4 weeks, 48.7% of the outpatients (follow-up) patients claimed that their asthma were well controlled compared to 27.1% in the outpatient (new) group and 25% in the inpatient group (P = 0.000).

In our study, we had no baseline for asthma severity in the form of lung function and independent specialist assessment of control to compare with the patient's survey response of the ACT. The nurses in charge of asthma patients clarified patients' response of the ACT to ensure thorough understanding of the survey questions. We hypothesised that patient-based assessments of Questions 3 and 4 are a valid source of information in rating patients' perception of their overall asthma control. The individual correlation between Questions 3 and 4 with Question 5 (patients' self-rating of

Table 3. Comparison of Patients' Self Rating of Asthma Control with Q3 and Q4

Question 3: Nocturnal symptoms							
Patients self rating	1. 4 or more times a week	2. 2 to 3 times a week	3. Once a week	4. Once or twice	5. Not at all	Total	*P*
1. Not controlled	12 (60)	5 (25)	2 (10)	0 (0)	1 (5)	20	<0.001
2. Poorly controlled	18 (32.1)	19 (34)	4 (7.1)	9 (16.1)	6 (10.7)	56	<0.001
3. Somewhat controlled	15 (12.6)	29 (24.4)	20 (16.8)	35 (29.4)	20 (16.8)	119	<0.001
4 . Well controlled	6 (3.8)	7 (4.5)	18 (11.4)	51 (32.5)	75 (47.8)	157	<0.001
5. Completely controlled	0 (0)	1 (2.1)	1 (2.1)	5 (10.6)	40 (85.1)	47	<0.001
Question 4: Use of rescue medication							
Patients self rating	1. 3 or more times a day	2. 1 or 2 times a day	3. 2 to 3 times a week	4. Once a week or less	5. Not at all	Total	*P*
1. Not controlled	12 (60)	6 (30)	1 (5)	0 (0)	1 (5)	20	<0.001
2. Poorly controlled	13 (23.2)	16 (28.6)	14 (25)	5 (8.9)	8 (14.3)	56	<0.001
3. Somewhat controlled	16 (13.5)	31 (26.0)	31 (26.0)	29 (24.4)	12 (10.1)	119	<0.001
4. Well controlled	9 (5.7)	12 (7.7)	17 (10.8)	68 (43.3)	51 (32.5)	157	<0.001
5. Completely controlled	0 (0)	1 (2.1)	1 (2.1)	7 (14.9)	38 (80.9)	47	<0.001

asthma control) would be a good indicator to determine whether patients were overestimating their asthma control.

Table 3 shows the correlation between ACT Question 5 (Patients self rating of asthma control) and Questions 3 and 4 individually.

Patients' Self rating of Asthma Control with Question 3 (Nocturnal Awakenings)

One hundred and fifteen (28.8%) patients who claimed that their asthma were well controlled to completely controlled had no episode of nocturnal symptoms compared to 7 (1.6%) in the poorly controlled group and non-controlled group (*P* <0.001).

Patients' Self rating of Asthma Control with Question 4 (Need for Rescue Medication)

Eighty-nine (22.3%) patients claimed that their asthma were well controlled to completely controlled did not use any rescue medication compared to 9 (2.3%) in the poorly controlled group and non-controlled group (*P* <0.001).

Table 4 shows the correlation between the derived ACT score and inpatient cost, LOS, and comorbidity.

The median cost for patients with a derived ACT score of ≥ 20 was $884.75 compared to $1355.20 for patients with score of ≤19 (*P* = 0.419). The median length of stay for patients with a derived ACT score of ≥ 20 was 1 day compared to 2 days for patients with a score of ≤ 19

(*P* = 0.373). One hundred and sixty (45.3%) patients with a derived ACT score of ≥20 had less than 3 comorbid medical history compared to 193 (54.7%) patients with a derived ACT score of ≤19 (*P* = 0.055).

Discussion

There is a need to characterise asthma control in different clinical practice settings because of its multidimensional nature and variability over time. In our institution, we used the ACT developed by Nathan et al[8] to assess asthma

Table 4. Correlation between Derived ACT Score and In-patient Cost, LOS, and Comorbidity

Variables	Controlled asthma (≥20)	Uncontrolled asthma (≤19)	*P*
Median inpatient cost	$884.75 Interquartile range ($713.60-$1766.50)	$1355 Interquartile range ($780.70-$1763.80)	0.419
Median length of stay (LOS)	1	2	0.373
Comorbidity ≤ than 3 comorbid medical history	160 (45.3%)	193 (54.7%)	0.055
≥ than 3 comorbid medical history	14 (30.4)	32 (69.6%)	

* The median cost (interquartile range) for the inpatient group is $1286 ($759-$1765).

control. The present study showed 225 (66.4%) of asthma patients reported a derived ACT score of ≤19, indicating that uncontrolled asthma remains highly prevalent in our practice. This trend is similar in many countries that state that many patients with asthma have far from optimal control.[7,10-12] An important finding was 94 (40.2%) patients in the outpatient follow-up group had poor asthma control. This was despite follow-up at a respiratory specialist clinic whereby they would have gone through counselling on asthma and self-management compared with patients who were new to the outpatient clinic and those in the inpatient settings. It has been reported that poor asthma control might stem from a number of causes, including insufficient treatment to changes in asthma control, under-assessment of asthma severity, poor compliance with treatment, insufficient patient education and socioeconomic factors.[7,13-15] In this study, we did not look at these other factors. Future research would be required to explore these areas including differences in the experience of treating physicians.

As hypothesised, the ACT scores for the 5 items assessed differed significantly across the 3 clinical practice settings. Patients in the inpatient and outpatient (new) groups had lower ACT scores in the 5 items assessed than patient in the outpatient (follow-up) setting. An element of bias was responsible for this finding. All patients in the out-patient (follow-up) group were enrolled into an asthma programme and treated by respiratory physicians. They were taught about asthma control and self-management by the nurse in charge. Being more well informed of the nature and prevention of the disease, these patients would be expected to be better at managing their asthma and thus their ACT scores would differ significantly from those patients who were from the new outpatient and inpatient settings.

In a previous study, it was reported that many patients tend to overestimate their levels of asthma control.[16] However our hypothesis was that when patients used the ACT tool to assess asthma control, they would not do so. To see if this was true, we looked at the correlation between the patients' self-rating of asthma control (Question 5) and night symptoms (Question 3), and the use of rescue medication (Question 4). Our findings were similar to the study by Nathan et al.[8] We found that patients were able to self-rate their level of asthma control according to their symptoms. A major limitation in our study was that we were unable to compare the patient's survey response of the ACT with the lung function and specialist assessment of control, unlike the study by Nathan et al.[8] However, our study demonstrated that patients could be an invaluable source of information for monitoring their asthma conditions. Patients' perceptions of illness are critical and should have a direct impact on the treatment. We also need to be cautious and ensure that the ACT which was administered by the patients was indeed an accurate assessment of their asthma control. Clarification

should be made when necessary. To elucidate this further, if we look at the analysis more carefully, there were 2 patients who perceived their asthma to be completely controlled but were using rescue medication more than 3 times a day and 38 (24%) patients who stated that their asthma were well controlled but were using rescue medication more than 3 times a day. We cannot exclude the possibility that these patients were instead using the inhaler as a form of rescue medication regularly and when necessary. Thirty-one (19.7%) patients who perceived that their asthma were well controlled also reported nocturnal symptoms more than once a week. As mentioned by Nathan et al,[8] clinicians should assess asthma control more effectively and flag these patients for regular reviews of treatments. Additional patient education and self-management could be reinforced to optimise their asthma control.

We agree with Nathan et al[8] that the ACT Question 3 on the assessment of impact of asthma on everyday functioning at school, work and home needs commentary. Asthma-related morbidity can have a significant impact on the patients' quality of life. In our clinical practice settings, we do not routinely assess the functional impact even though it is one of the GINA criteria for asthma control. Instead, we assessed asthma control using day and night clinical symptoms, methods of rescue treatment and amount of resource utilisation. This practice was similar to other clinicians who also often limit their assessment of patients to physiologic markers and symptoms.[7,17,18] By using ACT, we are now required to look at the impact of asthma on the functioning and role performance to improve the quality of life.

The impact of asthma on the economic aspect is imperative, and in Singapore, the overall economic burden was estimated at US$33.9 million (S$61 million).[4] Thus in this study, we explored the distribution of asthma control as described by the derived ACT score and the relationship between the derived ACT score with the cost of inpatient stay and the length of stay (LOS). Patients with a derived ACT score of ≥ 20 indicating their asthma was controlled reported a lower median cost of $884.75 [Inter Quartile (IQ): $713.60 to $1766.50] compared to patients with a derived ACT score of ≤ 19 (uncontrolled asthma) who incurred a median cost of $1355 (IQ: $780.70 to $1763.80). Even though the data showed a difference of $470.30, statistically, it was insignificant ($P = 0.419$) (Table 4). This finding is similar to the LOS for a patient with ACT score of ≥20 who reported a median LOS of 1 day compared with a patient with ACT score of ≤19 whose median LOS was 2 days. The LOS did not significantly differ between these 2 groups. Despite the difference of 1 additional day, our study did not show that the higher derived ACT scores were associated with significantly lower inpatient cost or lesser LOS ($P = 0.373$). The short LOS in

both groups might not be attributed to having mild asthma attacks or patients admitted early because the median LOS of asthma patients in this institution is just 2.5 days. Unlike other studies that found strong links between asthma control and medical resource utilisation and expenditure,[19,20] our study did not find such link. The difference is likely due to the small sample size of the inpatients group. We also did not look at the long-term medical utilisation and cost unlike the other studies. We also looked to see if patients with ≥ 3 comorbid medical histories were associated with uncontrolled asthma but it was also not statistically significant ($P = 0.055$). This was unlike the study by Peters et al[21] that identified comorbidities as an independent factor associated with uncontrolled disease. The limitation of these findings may be due to the fact that the study period was short and it only looked at the response of asthma control test questionnaire at the time of assessment in 3 clinical practice settings. We did not look at the recurrent healthcare utilisation and it was not possible to include medication cost for the outpatient group because some patients might not have filled out their prescription as prescribed and it would not reflect the true full cost analysis of the outpatient visits. In short, our results highlight the need for greater emphasis on the management of patients with uncontrolled asthma. Clinicians need to be aware that a significant proportion of patients in our population have uncontrolled asthma. We should continue to use the ACT at each clinical visit and compare the assessments over time to achieve optimal asthma control.

Conclusion

In conclusion, about two-thirds (66.4 %) of our study population reported a derived ACT score of ≤19 indicating uncontrolled asthma, which was highly prevalent in our hospital setting.

It also showed that the ACT scores differed significantly across the 3 clinical practice settings. Patients from the inpatient and outpatient (new) groups had lower ACT scores compared to patients from the outpatient (follow-up) group. However, patients were able to rate their levels of asthma control according to their symptoms and majority of them did not overestimate their control. This suggests that ACT is a useful tool to identify patients with uncontrolled asthma. Finally, this study did not show an association of derived ACT score with cost, LOS and comorbidity. Thus we recognise that the ACT is a useful and simple assessment tool that is able to detect clinically meaningful scores to rate asthma control without requiring additional resources like spirometry. We encourage both clinicians and patients to use this tool to assess the severity of asthma and to optimise asthma control. Although the ACT performs well in the absence of spirometry, we suspect the best measure of control in a respiratory specialist setting would be a combination of both ACT and spirometry as there could still be a discrepancy between the perception of asthma control and an objective assessment by pulmonary function.[7]

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