RESEARCH PAPER

Impact of cigarette smoking on symptoms and quality of life of adults with asthma managed in public primary care clinics in Singapore: a questionnaire study

*Ngiap Chuan Tan^a, Soh Heng Agnes Ngoh^a, Stephanie Swee Hong Teo^a, Teck Sin Swah^a, Zhaojin Chen^b, Bee Choo Tai^c

^a SingHealth Polyclinics, Pasir Ris, Singapore

^b Investigational Medicine Unit, National University Health System

^c Saw Swee Hock School of Public Health, National University Singapore

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Abstract

Background: Cigarette smoking aggravates asthma exacerbations, yet some patients with asthma continue to smoke.

Aims: To compare the quality of life of adult smokers and non-smokers with asthma.

Methods: Asthma Quality of Life (AQLQ) questionnaires were administered to adult patients with asthma managed in primary care in Singapore. The survey also included data of their asthma status including symptom profiles. Independent two-sample t-test, ANCOVA model, χ^2 test and ordinal logistic regression were used to compare the mean domain scores and the effect of smoking on nocturnal symptoms and awakening, respectively.

Results: 357 adult asthma patients (183 non-smokers and 174 smokers) were recruited. Smokers were mainly male ($p < 0.001$), single ($p = 0.008$), and younger (mean age 30 years) ($p = 0.007$). They were more affected by nocturnal cough and wheezing ($p = 0.016$). After adjustment for age, gender, and asthma medications, the mean scores of the AQLQ 'symptoms' and 'emotional function' domains of smokers were 0.41 (95% CI 0.10 to 0.72) and 0.50 (95% CI 0.16 to 0.84) points lower than for non-smokers, with no statistical differences in the 'activity limitations' and 'exposure to environmental stimuli' domains.

Conclusions: Adult patients with asthma who smoke are more affected by nocturnal symptoms, with lower 'emotional function' scores in the AQLQ.

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Introduction

Cigarette smoking in adult patients with asthma is associated with worse symptom control, increased emergency department admission rate for exacerbations, increased deterioration of pulmonary function, and an increased mortality rate.¹ Despite being recognised as a trigger of asthma exacerbations, up to one third of adults with asthma in developed countries are current cigarette smokers.² The smoking habits of these asthma patients are reported to be similar to those in the general population.² However, little is known about the impact of smoking on the quality of life (QOL) of the local adult asthma population in

Singapore, where they can readily access asthma care in public and private primary care clinics.

The aims of this study were to assess the QOL of asthma patients managed in public primary care clinics in Singapore and to determine if there is any difference between those who smoke and those who do not.

Methods

The study subjects comprised adult asthma patients being followed up in three public primary care clinics in Singapore (Bedok, Geylang, and Pasir Ris). During the study period an

* Corresponding author: Dr Ngiap Chuan Tan, SingHealth Polyclinics, Pasir Ris, 1, Pasir Ris Drive 4, #01-11, Singapore, 519457, Singapore
Tel: +65-65855395 Fax: +65-65853693 E-mail: Tan.Ngiap.Chuan@singhealth.com.sg

electronic decision support system was in place at all primary care clinics within the healthcare organisation to standardise the clinical pathway and pharmacological treatment of all asthma patients. All patients with chronic diseases, including asthma, are routinely screened for a history of smoking. Adult asthma patients of major ethnic groups (Chinese, Malay, Indian, and others) aged 21–50 years were recruited consecutively at the study sites after obtaining their written consent. Their clinical diagnosis of asthma was cross-referenced to their clinical records. The participants were enrolled if they could read or understand English. ‘Smokers’ included patients diagnosed with bronchial asthma who had smoked at least one cigarette within the preceding 6 months of the survey. ‘Non-smokers’ were classified as asthma patients who had never smoked or who had quit smoking for >6 months.

The questionnaire collected data about the symptoms, smoking details, and treatment of the subjects, and the English version of the Asthma Quality of Life Questionnaire³ (AQLQ) was administered to elicit QOL information. Treatment groups included subjects who were receiving inhaled corticosteroids (ICS), including inhaled ICS alone and in combination with long-acting β_2 -agonists (LABA), and those without any controller medications.

The AQLQ, validated in multi-ethnic Singapore,⁴ was selected for use in this study as English is the lingua franca of all major ethnic groups. The questionnaire was largely self-administered by participants who could understand English. If the participants had any queries on the questionnaire these were immediately clarified by the investigators. The answer to each question was scored on a 7-point scale, with the lower score indicating greater impairment. The items were weighted equally. The mean score was reported for each of the four domains of activity limitation, emotions, symptoms, and exposure to environmental stimuli, as well as the total score. The study was approved by the investigators’ institution review board.

Three hundred and fifty subjects were required to be recruited for the study based on an anticipated mean score of 4.5 in non-smokers and 4.0 in smokers, with a common standard deviation of 1.4 for the domain of symptoms in the AQLQ, in order to achieve a power of 90% at the 5% significance level. Mean domain scores were compared using the independent two-sample t test and the ANCOVA model. The effect of smoking on nocturnal symptoms and awakening were compared using the χ^2 test and ordinal logistic regression. Age, gender, and controller medication were considered for adjustment in the multivariable models. All statistical analyses were made assuming a two-sided test at the conventional 5% significance level using the statistical software Stata Version 11 (StataCorp LP, College Station, TX, USA).

Results

A total of 372 subjects were approached for the study between 2009 and 2010; 357 subjects completed the study (183 non-

Table 1. Demographic and clinical characteristics of asthmatic non-smokers and smokers

	Non-smokers (n = 183)	Smokers (n = 174)	p value
Age, median (range)	37 (21–50)	30 (21–50)	0.007
Gender, n (%)			<0.001
Male	62 (33.9)	131 (75.3)	
Female	121 (66.1)	43 (24.7)	
Race, n (%)			0.210
Chinese	59 (32.2)	41 (23.6)	
Malay	99 (54.1)	100 (57.5)	
Indian	15 (8.2)	17 (9.8)	
Others	10 (5.5)	16 (9.1)	
Education, n (%)			0.423
None/primary	40 (21.9)	36 (20.7)	
Secondary	82 (44.8)	88 (50.6)	
JC/Diploma/Polytechnic	40 (21.9)	42 (24.1)	
Tertiary	21 (11.4)	8 (4.6)	
Marital status, n (%)			0.008
Single	81 (44.3)	105 (60.3)	
Married	88 (48.1)	62 (35.6)	
Divorced/separated/widowed	14 (7.6)	7 (4.1)	
Number of children, n (%)			0.482
≤2	46 (47.4)	35 (53.0)	
>2	51 (52.6)	31 (47.0)	
Controller medication, n (%)	102 (55.7)	77 (44.2)	0.030

smokers and 174 smokers), constituting a response rate of 96%.

The demographic profiles of the patients are shown in Table 1. Smokers were mostly male ($p<0.001$), younger (median age 30 years, $p=0.007$), and single ($p=0.008$). There was no difference in relation to their ethnic distribution, educational status, and number of children in the family (for those who were married, divorced or widowed). The proportion of Malay patients recruited was higher in the study than their ethnic distribution in the general population in Singapore in 2010 (13.4%).⁵

Smokers had an increased frequency of nocturnal cough and/or wheezing ($p=0.016$), as shown in Table 2. Differences in daytime symptoms, nocturnal breathlessness and awakening, interference with daily activities of living, and hospitalisation in the past year were not statistically significant between the two groups of patients.

Smokers with asthma had more nocturnal cough and/or wheezing (adjusted odds ratio (OR) 1.71, 95% CI 1.10 to 2.65), nocturnal dyspnoea (adjusted OR 1.39, 95% CI 0.88 to 2.19), and frequent nocturnal awakening (adjusted OR 1.84, 95% CI 1.02 to 3.32) (Table 3).

Table 4 shows that the use of asthma controller medications was inversely related to the patients’ QOL scores in all four AQLQ domains. Gender was another potential confounding factor, but it was not statistically associated with the QOL in this study. Thus, after adjustment for age, gender, and prescribed controller medications, patients with asthma who smoked had lower mean QOL scores for the ‘symptoms’ (adjusted mean difference –0.41,

Table 2. Comparison of symptom details between non-smokers and smokers with asthma

	Non-smokers (n = 183)	Smokers (n = 174)	p value
Coughing and/or wheezing during daytime, n (%)			0.605
<1 time/week	96 (52.5)	90 (51.7)	
≥1 times/week but <1 time a day	64 (35.0)	54 (31.0)	
Every day	23 (12.5)	30 (17.3)	
Coughing and/or wheezing during night time, n (%)			0.016
<2 times/month	93 (50.8)	65 (37.4)	
≥2 times/month	63 (34.4)	76 (43.7)	
Every day	27 (14.8)	33 (18.9)	
Shortness of breath during daytime, n (%)			0.405
<1 time/week	115 (62.8)	103 (59.2)	
≥1 times/week but <1 time/day	56 (30.6)	55 (31.6)	
Every day	12 (6.6)	16 (9.2)	
Shortness of breath during night time, n (%)			0.099
<2 times/month	110 (60.1)	91 (52.3)	
≥2 times/month	58 (31.7)	61 (35.1)	
Every day	15 (8.2)	22 (12.6)	
Awakened at night because of asthma, n (%)			0.242
Yes	110 (60.1)	115 (66.1)	
No	73 (39.9)	59 (33.9)	
How many times night awakening, n (%)			0.106
≤2 times/month	68 (61.8)	63 (50.8)	
>2 times/month	32 (29.1)	47 (37.9)	
Every day	10 (9.1)	14 (11.3)	
Daily activity (such as work duties, housework, school and sports) disrupted, n (%)			0.792
Yes	93 (50.8)	86 (49.4)	
No	90 (49.2)	88 (50.6)	
Been hospitalised at least once in the past year for asthma, n (%)			0.477
Yes	14 (7.6)	17 (9.8)	
No	169 (92.4)	157 (90.2)	

Table 3. Ordinal logistic regression of effect of smoking on symptom details

	Crude OR (95% CI)	Adjusted OR* (95% CI)
Coughing and/or wheezing during night time	1.62 (1.09 to 2.40)	1.71 (1.10 to 2.65)
Shortness of breath during night time	1.41 (0.94 to 2.12)	1.39 (0.88 to 2.19)
How many times night awakening	1.52 (0.92 to 2.52)	1.84 (1.02 to 3.32)

* Adjusted for age, gender and controller medication.

Table 4. Comparison of mean score of AQLQ domains between smokers and non-smokers with asthma

AQLQ domain	Adjusted mean difference (95% CI)	p value
Activity limitations		
Smoking	−0.18 (−0.46 to 0.09)	0.183
Age	0.02 (0.01 to 0.03)	0.014
Gender	−0.22 (−0.49 to 0.05)	0.108
Controller medication	−0.36 (−0.61 to −0.11)	0.005
Symptoms		
Smoking	−0.41 (−0.72 to −0.10)	0.010
Age	0.02 (0.01 to 0.04)	0.001
Gender	−0.01 (−0.32 to 0.31)	0.973
Controller medication	−0.43 (−0.72 to −0.14)	0.003
Emotional function		
Smoking	−0.50 (−0.84 to −0.16)	0.004
Age	0.01 (−0.01 to 0.03)	0.076
Gender	−0.20 (−0.54 to 0.13)	0.235
Controller medication	−0.46 (−0.77 to −0.15)	0.004
Exposure to environmental stimuli		
Smoking	−0.23 (−0.55 to 0.09)	0.165
Age	0.01 (−0.01 to 0.03)	0.077
Gender	−0.05 (−0.37 to 0.27)	0.748
Controller medication	−0.42 (−0.71 to −0.13)	0.005

95% CI −0.72 to −0.10) and ‘emotions’ (adjusted mean difference −0.50, 95% CI −0.84 to −0.16) domains in the AQLQ. Significant differences were not noted in the ‘activity limitations’ and ‘exposure to environmental stimuli’ domains.

Discussion

Main findings, and interpretations in relation to previously published work

Assessing patients’ QOL adds another dimension to the holistic management of asthma. The AQLQ instrument allows such assessment beyond the usual parameters of asthma control. It determines the asthma status of patients in terms of activity limitations, their emotions, symptoms, and exposure to environmental stimuli in four separate domains. In particular, the impact of asthma on patients’ emotions may be overlooked. Mancuso *et al.*⁶ showed that AQLQ scores were lower in asthma patients with depressive symptoms. In this study, asthma patients who smoked had a similarly reduced mean score in the ‘emotional function’ domain of their QOL assessment.

A study by Zhang *et al.*⁷ found that cigarette smokers showed disturbances in their sleep EEG pattern, with significantly more complaining of lack of restful sleep compared with non-smokers. Nicotine increases vigilance and is associated with difficulty in initiating and maintaining sleep.⁸ This may result in a reduced capacity to cope with stress, leading to susceptibility to emotional disturbance. To keep themselves awake during daylight hours, smokers continue to smoke which could further

aggravate their nocturnal symptoms and worsen their sleep.

The lower mean score in the AQLQ 'symptoms' domain among smokers is also in line with current evidence that active smoking is associated with worsening of symptoms.¹ This study showed that asthma patients who smoke had more frequent symptoms, particularly at night, which could affect their sleep.

Lange *et al.*⁹ showed an accelerated decline in pulmonary function in patients with asthma compared with non-asthma patients, and found that asthma patients who smoke fared even worse than non-smoking asthma patients. This would further impact on the symptoms and QOL of asthma patients who smoke.

Smoking cessation is a key intervention to relieve these patients of their symptoms and improve their asthma control. Another smoking cessation strategy could focus on QOL improvement in terms of freedom from irritating nocturnal symptoms and better quality sleep. Smokers with asthma should also be made aware of additional benefits including improved lung function after quitting for 6 weeks.¹⁰

Strengths and limitations of this study

Patients on asthma controller medications had lower QOL scores. Based on clinical practice guidelines, patients with persistent asthma would require daily use of controller medications, the dose of which increases with increasing asthma severity. Thus, the use of controller medications could be a surrogate marker of asthma severity, which is associated with poorer QOL. The statistical analysis was based on the assumption that the patients adhered to their prescribed pharmacotherapy. However, their actual use of the medications was not verified, which might confound the study results.

A disproportionately higher number of Malay patients were recruited to this study in comparison with the constitution of the Malay ethnic group in the general population. However, only participants (including Malays) who could speak and understand English were enrolled into the study. Nonetheless, the Singapore 2000 population census showed a slightly higher prevalence of the Malay population at the two survey sites (Pasir Ris (20.3%) and Bedok (16.0%)), while Geylang (12.8%) was close to the national distribution of 13.4%.⁵ The Singapore National Health Surveillance Survey showed that the prevalence of reported lifetime asthma was higher among Malays (11%) than among Indians (6.2%) and Chinese (5.9%).¹¹ It also showed that the age-standardised prevalence of daily smoking among Malays increased from 21.6% to 23.8% between 2001 and 2007.¹¹ In view of the disproportionately higher percentage of a minority

ethnic group in this study, caution has to be exercised in extrapolating the results to the adult asthma population in Singapore. Nonetheless, the study was not intended to determine the impact of smoking on the QOL of the various ethnic groups; an epidemiological study by design would be more appropriate to determine such association.

Conclusions

Smokers with asthma appear to experience poorer QOL and increased asthma symptoms, and their emotional state is affected. Sleep disturbance directly related to smoking or secondary to nocturnal symptoms could account for these adverse effects.

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Contributorship NCT conceptualised the study design, interpreted the results, and wrote the draft for the manuscript; SHAN and SHST conceptualised the study design and collected the data; TSS designed the questionnaire; ZJC and BCT analysed the results and co-wrote the manuscript.

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