OUTPATIENT ADULT BRONCHIAL ASTHMA IN SINGAPORE

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ABSTRACT

Objectives – To describe the clinical pattern and drug use in adult bronchial asthma seen in Government polyclinics (primary health care centres).

Design – A cross-sectional study using a structured questionnaire.

Setting – The five largest Government polyclinics in Singapore.

Subjects – Eight hundred and two subjects aged between 21-58 years drawn from the register of outpatient attendances. The response rate was 63%.

Results – The mean age of the study subjects was 37.4 years and the mean age of onset was 19.2 years. Thirty-three percent had onset of asthma under 10 years old. The most commonly reported trigger factors were cold drinks (67%), a change of temperature or humidity (65%), influenza or colds (65%), house dust (58%) and cigarette smoke (37%). In 27%, the work environment was a provoking factor. One-fifth had attacks every night or every day. About half of the patients had FEV_1 under 80% of predicted. In the past year, 10% had 4 or more acute attacks requiring emergency attendance, 18% had one or more hospital admissions and 21% had sickness absence from asthma for one week or more. Of the 186 subjects who needed bronchodilators/inhalers 3 times or more a day, only 19.3% were on inhaled steroids.

Conclusions – Considerable morbidity existed amongst outpatient asthmatics. Inhaled steroids appeared to be under-used.

Keywords: bronchial asthma, adult, Singapore, inhaled steroids, morbidity.

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INTRODUCTION

There is currently a worldwide concern in the rising trend of morbidity and mortality in bronchial asthma despite the availability of effective beta-agonist bronchodilators and inhaled anti-inflammatory agents like disodium cromoglycate and inhaled steroids[1]. Conventional teaching has been to use steroids only after beta-agonists and xanthines have been found unable to control the disease. The current understanding is that bronchial asthma is more than a bronchospastic condition but rather that there is often a continuing inflammatory process in the bronchioles[2]. Management guidelines have been drawn up advocating the earlier use of inflammatory agents in patients; inhaled steroids should be considered in patients who require bronchodilators more than once a day, provided of course, aerosol inhalation techniques and compliance to drug use were checked and found to be satisfactory[3,4].

In Singapore, a questionnaire survey by Chong in 1972[5] of 36,127 persons aged between 4-30 years (mostly school children and a few teachers) showed the prevalence of asthma to range from 2.5 to 5.5% and between 0.5 to 2.0% had active asthma. A recent survey[6] of adults showed that 4.7% of males and 4.3% of females had asthma; 2.4% of males and 2.0% of females currently had asthma in the past year. More Malays and Indians were noted to have asthma than the Chinese. Drug use and frequency of attacks have not been studied. The present study was therefore done to provide a baseline for future comparison in anticipation of a wider implementation of the stepped care management and patient education on self-care in line with the new international guidelines. In this study Government polyclinics were chosen because data on each patient visit is captured on computer together with the diagnosis; it was therefore possible to obtain a register of patients who were seen for bronchial asthma in the past year as subjects for such a study; a period of the preceding twelve months was chosen for ease of recall and follow-up. Patients consulting private medical practitioners on the other hand, were not studied because of difficulties with patient selection and response rate.

PATIENTS AND METHODS

Patients

The cases in the study were adult patients (aged 20-54 years) with asthma who sought acute and continuing care in the five largest Government polyclinics (primary health care centres). The cases were identified from a register of asthma cases who were last seen in each study centre in the previous year. The clinical case notes of these patients were scrutinised by the five doctors participating in the study and only those subjects who met the criteria of typical symptoms of wheeze, breathlessness and shortness of breath, at least one recorded diagnosis of bronchial asthma, and at least one clinical documentation of rhonchi/diminished air entry were invited by letter to come for an interview at the polyclinic of their attendance.

A total of 1,344 cases in the register were sent letters and/or

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contacted by the telephone. Sixty-eight letters were returned because of invalid addresses, 50 could not attend for various reasons such as being abroad, imprisonment, mental or physical disability or death. Four hundred and twenty-three did not respond or refused for various reasons such as lack of time, inconvenience and cessation of symptoms. The rest, totalling 802 patients, were successfully interviewed between March and August 1992 and these formed the study group, giving a response rate of 63%. The demographic characteristics of cases interviewed and cases not interviewed are shown in Table I.

Table I – Demographic characteristics of cases interviewed compared with cases not interviewed

	Cases Not Interviewed		Cases Interviewed	
	No	%	No	%
Total	568	100.0	802	100.0
Sex				
Males	283	49.8	338	42.1
Females	285	50.2	464	57.9
Ethnic group				
Chinese	211	37.1	385	48.0
Malays	202	35.6	249	31.0
Indians	128	22.5	153	19.1
Others	27	4.8	15	1.9
Age				
20-29	207	36.4	176	21.9
30-39	200	35.2	274	34.2
40-58	161	28.4	352	43.9

Questionnaire

A standardised questionnaire covering demographic information, occupation, family and past history, smoking, symptoms, frequency of attacks, hospitalisation, visits for acute episodes, sick leave, provoking factors, knowledge about asthma and use of drugs was administered to each patient by the participating doctors, each assisted by a field investigator.

The height and weight of each subject were taken. Pulmonary function was measured using a pocket size electronic turbine spirometer (Micro spirometer, Mirco Medical Limited). Validation studies have shown that the performance of these hand-held spirometers in the clinical setting compare well against Vitalography and Wright peak flow meter readings [7,8].

In this study at least three "satisfactory" blows were recorded, and the subject's technical performance was assessed by the doctor and readings which were considered "technically unsatisfactory" were discarded. Previous studies indicate[9], and the results of our own validation studies also confirm, that the forced vital capacity measured by the turbine spirometer is liable to be systematically under-estimated because of insufficient completion of forced expiration without the aid of a graphical presentation of the volume-time curve. For this reason, only the forced expiratory volume in one second (FEV_1) was used to assess the degree of airway obstruction.

The measured FEV_1 was expressed as a percentage of the predicted FEV_1 based on the patient's age and height, using separate prediction equations for each sex and ethnic group. The equations were derived from data of lung function values taken with the same instrument from healthy non-smoking adults in Singapore[6].

Statistical analysis

Statistical analysis was done using *Dbase III plus and Kwikstat*, the latter a statistical package produced by Texasoft.

RESULTS

Patient characteristics

Demographic characteristics

Table II shows the demographic characteristics of the study population. The mean age of the patients was 37.4 years (SD 8.8 years and ranged from 21 and 58 years). Forty-two percent were males. The proportion of Malays (31%) and Indians (19%) were higher than expected from the general distribution of ethnic groups of patients attending Government polyclinics. A more detailed study of the ethnic differences in occurrence of asthma and disease severity was reported in a separate paper elsewhere.

Table II – Characteristics of study population

Characteristics	Study population	Horn & Cochrane[10]*
Number of respondents	802	312
Sex		
male	42.1%	49.7%
Ethnic group		
Chinese	385 (48.0%)	
Malays	249 (31.0%)	
Indians	154 (19.1%)	
Others	15 (1.9%)	
Age distribution		
mean	37.4 years (SD 8.8)	40.7 years (SD 18.3)
range	21-58 years	16-83 years
20-29	176 (21.9%)	
30-39	274 (34.2%)	
40-49	269 (33.5%)	
50-58	83 (10.4%)	
Age at onset of asthma		
mean	19.2 years (SD 13.9)	18 years (19.6)
range	<1-56 years	<1-78 years
onset < 10 years	33.0%	80.0%
Duration of asthma		
mean	18.2 years (SD 12.8)	17.8 years (SD 15.1)
range	1-52 years	1-71 years
Smoking		
Non smoker	589 (73.4%)	115 (36.9%)
Ex-smoker	83 (10.3%)	84 (26.9%)
Current smoker	130 (16.3%)	113 (36.2%)
Percent predicted FEV_1**		
80 or greater	316 (44.3%)	153 (49.0%)
50-79	273 (38.2%)	117 (37.5%)
30-49	113 (15.8%)	55 (17.6%)
< 30	12 (1.7%)	7 (7.1%)
Mean	75.8% (SD 25.2)	74.9% (SD 26.1)

Note (*) – Study of adult bronchial asthmatics seen in two general practices linked to a London hospital academic department.

Note (**) – Percent predicted FEV_1 was available in 714 subjects only.

Rhinitis, atopy and family history of bronchial asthma

Forty-six percent of asthmatic patients (n=369) had a history of rhinitis and 24.8% (n=199) had a history of skin rash. Forty-six percent of asthmatic patients (n=367) had a positive family history.

Age of onset and duration of asthma

Table II also shows the mean onset age of asthma for the whole group. It was 19.2 years (SD 13.9 years, range: less than a year to 56 years). Thirty-three percent had onset age of asthma under

10 years old. In this group, the mean age of onset was 4.4 years (SD 2.6 years, range: less than one year to 9 years). The mean age of onset in those with onset later than 10 years was 26.5 years (SD 11.1 years, range: 10 to 56 years). The mean duration of asthma in the whole group was 18.2 years (SD 12.8, range: less than 1 to 52 years).

Smoking

Table II shows three-quarters of the subjects in this study were non-smokers. Ten percent were ex-smokers and 16% were current smokers. Further examination of the association between smoking and asthma occurrence and clinical severity is reported in a separate paper elsewhere.

Trigger factors

The most commonly reported trigger factors reported by patients in this study were cold drinks (67%) and a change of temperature or humidity (65%), influenza or colds (65%), house dust (58%) and cigarette smoke (37%). Work environment was a provoking factor in 27% of subjects. Pets were provoking factors in 14% and pollen and grass in 13% (See Table III).

Table III – Asthma trigger factors – a comparison with reported studies

Trigger factor	This study, 1992	Ross[15] 1984	Turner-Warwick[11], 1989	Barritt & Staples[12], 1984
Number of subjects	802	50	7,729	126
Cold drinks	67%	–	–	–
Temperature or humidity change	66%	50%*	–	67%
Influenza, colds, respiratory infections	65%	–	57%	83%
House dust	58%	68%	56%	45%
Foods	55%	–	26%	–
Strenuous exercise	49%	48%	56%	68%
Emotional upset	41%	–	45%	56%
Cigarette smoke	37%	34%	–	47%
Glues, adhesives	37%	–	–	–
Insecticide sprays	34%	–	–	–
Hair sprays, perfumes	31%	–	–	–
Petrol, diesel	27%	–	–	–
Work environment	27%	33%	–	22%
Cooking fumes	18%	–	–	–
Pets	14%	48%	42%	39%
Mosquito coils	13%	–	–	–
Pollen, grass	13%	–	46%	54%
Household cleaners	12%	–	–	–
New furniture	12%	–	–	–
Medicines	7%	–	–	–

Note: * denotes 'wet periods'

Morbidity

Breathlessness

Fourteen percent of the asthmatics felt breathless at rest and a further 41% were breathless on exertion. Of the latter, one-third (133 out of 532) were breathless when walking with other people of their own age on level ground and one quarter (105 out of 532) had to stop for breath when walking at their own pace on level ground, while the rest were breathless when walking up a slight incline or hurrying on level ground.

Respiratory function

The mean FEV_1 for subjects who had respiratory function tests done (714 out of 802 subjects) was 75.8% (SD 25.2) of the predicted value. Only 44.3% had a "normal" FEV_1 (ie 80% or greater of the predicted value); in 17.5%, it was below 50% predicted; and in 1.7% (12 patients), it was less than 30% of the predicted value.

Frequency of asthmatic attacks and progression in the past year

Table IV shows the distribution of day and night attacks by frequency. More patients appeared to be symptomatic at night than during the day. Thus, 17% experienced attacks every night compared to 11% who experienced daytime attacks daily.

The frequency of day or night attacks of asthma were graded as extremely frequent, very frequent, frequent and infrequent as shown in Table IV. About one-fifth of patients had daily day or night attacks of asthma. Subjects were asked to gauge the progress of their asthma over the past year. Sixteen percent perceived they had more frequent attacks, 40% had less frequent attacks, and the rest either had no change in frequency of attacks or the frequency of attacks waxed and waned over time.

Table IV – Asthma morbidity over last one year (n=802)

	No	(% n)
Day attacks		
Every day	85	(10.6)
4-6 times a week	18	(2.2)
1-3 times a week	67	(8.3)
1-3 times a month	93	(11.6)
Less frequently than monthly	522	(65.1)
Not at all	17	(2.2)
More than once weekly	170	(21.1)
Night attacks		
Every night	139	(17.3)
4-6 times a week	33	(4.1)
1-3 times a week	78	(9.7)
1-3 times a month	122	(15.2)
Less frequently than monthly	421	(52.6)
Not at all	9	(1.1)
More than once weekly	250	(31.1)
*Overall frequency (day or night attacks)**		
Extremely frequent (daily day/night attacks)	159	(19.8)
Very frequent (1-6 attacks a week)	124	(15.5)
Frequent (1-3 attacks a month)	127	(15.8)
Infrequent (less than 1 attack a month)	392	(48.9)
Exercise disability		
Breathless at rest	112	(14.0)
Breathless on exertion	327	(40.8)
Nil	363	(45.2)
Absence from work/school		
Nil	308	(38.4)
1-6 days	328	(40.9)
1 week or more	166	(20.7)
A week or more in a year	166	(20.7)
Use of medical service: GP and A&E visit in last year		
nil	11	(1.4)
1 visit	599	(74.7)
2-3 visits	110	(13.7)
4 and more visits	82	(10.2)
At least four or more times in a year	82	(10.2)
Use of medical service: Hospitalisation		
nil	696	(86.8)
1-2 times	78	(9.7)
3 and more times	28	(3.5)
At least once in the past year	106	(13.2)

Note(*) – Overall frequency is computed by accepting as the grade of frequency the more severe of the night or day attack frequency.

Acute attacks, hospitalisation and sickness absences

Table IV shows 98% of the subjects had at least one acute attack

requiring attendance at the general practitioner's clinic or the Accident & Emergency Department in a hospital in the past year. Ten percent had four or more such attacks in the past year. Thirteen percent had one or more attacks requiring hospitalisation in the past year. The mean sickness absence in the study group was 0.6 week (SD 0.9). Twenty-one percent were sickness absent for one week or more due to bronchial asthma in the past year. As shown in Table V, acute attacks, hospitalisations and sickness absence were all related to the frequency of attacks.

Table V – Relationship between frequency of attacks, sickness absences and acute attacks and hospitalisation (n=802)

Morbidity	Number	Overall frequency of attacks			
		Infreq No. (%)	Freq No. (%)	V Freq No. (%)	E Freq No. (%)
All patients	802	392 (48.9)	127 (15.8)	124 (12.5)	159 (7.0)
Sickness absence					
Nil	308	170 (55.2)	38 (12.3)	51 (16.6)	49 (15.9)
1-6 days	328	176 (53.6)	55 (16.8)	37 (11.3)	60 (18.3)
1 week or more	166	46 (27.7)	34 (20.5)	36 (21.7)	50 (30.1)
Acute attacks					
Nil	11	8 (72.7)	2 (18.2)	1 (9.1)	–
1 visit	599	332 (55.4)	84 (14.0)	85 (14.2)	98 (16.4)
2-3 visits	110	39 (35.5)	23 (20.9)	16 (14.5)	32 (29.1)
4 and more visits	82	13 (15.8)	18 (22.0)	22 (26.8)	29 (35.4)
Hospitalisation					
Nil	696	359 (51.6)	108 (15.5)	107 (15.4)	122 (17.5)
1-2 times	78	24 (30.8)	15 (19.2)	16 (20.5)	23 (29.5)
3 and more times	28	9 (32.1)	4 (14.3)	1 (3.6)	14 (50.0)

Key: Infreq = infrequent (less than 1 attack a month); Freq = frequent (1-3 attacks a month); V Freq = Very frequent (1-6 attacks a week); E Freq = Extremely frequent (daily daytime/night-time attacks).

Drug use in bronchial asthma

The mean number of drugs prescribed was 2.0 (SD 1.0). The mean number of drugs prescribed was similar amongst the ethnic groups and in both the sexes. It was related to frequency of attacks; the mean number of drugs prescribed was 1.8 for those with infrequent attacks, 1.9 (SD 1.0) for those with frequent asthma, 2.2 (SD 1.1) for those whose asthma was very frequent and 2.4 (SD 1.0) drugs for those with extremely frequent day or night attacks. The differences were statistically significant ($p<0.001$).

Beta-agonists

Inhaled beta-agonists and oral beta-agonists were prescribed to 59.0% and 81.9% respectively of all patients (Table VI). Twenty-nine percent used inhaled beta-agonists regularly or both regularly and on demand (Table VII). The majority of the patients were on salbutamol inhalers. A few were on terbutaline inhalers. Similarly for tablets, more than 90% of the patients were on salbutamol with the remainder on terbutaline.

Xanthines

Xanthines were prescribed to 36.3% of patients (Table VI). The proportion of patients on this increased from 3% of all patients on only one drug, to 32.2% of all patients on two drug combinations, to 80% of all patients on three drug combinations. One hundred and thirty-nine subjects had nightly attacks; of these 56.8%, were on theophyllines.

Inhaled steroids and oral steroids

Inhaled steroids were prescribed to 12.5% of patients overall. Of all patients on two drug and three drug combinations, inhaled steroids were prescribed to only 6.6% and 18.8% of patients respectively. Only in patients on four or more drug combinations, were inhaled steroids more frequently prescribed (Table VI). Of the 186 subjects who needed bronchodilator tablets/inhalers 3 times or more a day, only 19.3% were on inhaled steroids. Of the patients who had FEV_1 done (n=714), in those with FEV_1 below 50% predicted only 16.8% (19 out of 113) were on inhaled steroids. Also 42% of the subjects on steroid inhalers were using them only on demand rather than regularly (Table VII). Eighty-five percent of the subjects on inhaled steroids were on beclomethasone while 13% were on budesonide and two were on beclomethasone forte. Most of the patients on oral steroids were on short courses of prednisolone.

Table VI – Distribution of subjects by number and type of drugs prescribed (n=802)

Number of Drugs	Drugs prescribed					
	Total n (% n)	B-inh n_1 (%n)	B-tab n_2 (%n)	X-tab n_3 (%n)	S-inh n_4(%n)	S-tab n_5(%n)
Nil	36 (4.5)	–	–	–	–	–
1	264 (32.9)	47 (17.8)	206 (78.0)	8 (3.0)	2 (0.8)	1 (0.4)
2	270 (33.7)	198 (73.3)	236 (87.4)	87 (32.2)	13 (6.6)	6 (0.2)
3	165 (20.6)	160 (97.0)	151 (94.4)	132 (80.0)	30 (18.8)	22 (8.3)
4	58 (7.2)	58 (100.0)	55 (94.8)	55 (94.8)	46 (79.3)	18 (31.0)
5	9 (1.1)	9 (100.0)	9 (100.0)	9 (100.0)	9 (100.0)	9 (100.0)
Total	802	473	657	291	100	56
(% n)	(100.0)	(59.0)	(81.9)	(36.3)	(12.5)	(7.0)

Key: n, n_1, n_2, n_3, n_4, n_5 = number of subjects; B-inh = Beta-agonist inhaler; B-tab = Beta-agonist tablet; X-tab = theophylline tablet; S-inh = Steroid inhaler; S-tab = Steroid tablet. There were no patient on disodium cromoglycate.

Table VII – Distribution of subjects by regularity of drug use (n = 802)

Regularity of use	Drugs prescribed				
	B-inh n_1 (%n)	B-tab n_2 (%n)	X-tab n_3 (%n)	S-inh n_4(%n)	S-tab n_5(%n)
Regular use	60 (12.6)	140 (21.3)	104 (35.7)	37 (37.0)	13 (23.2)
On demand	337 (71.3)	416 (63.3)	118 (40.6)	42 (42.0)	38 (67.9)
Both	76 (16.1)	101 (15.4)	69 (23.7)	21 (21.0)	5 (8.9)
Total	473 (100.0)	657 (100.0)	291 (100.0)	100 (100.0)	56 (100.0)
(% n)	(59.0)	(81.9)	(36.3)	(12.5)	(7.0)

Key: n, n_1, n_2, n_3, n_4, n_5 = number of subjects; B-inh = Beta-agonist inhaler; B-tab = Beta-agonist tablet; X-tab = theophylline tablet; S-inh = Steroid inhaler; S-tab = Steroid tablet.

DISCUSSION

Response rate

The response rate in this study was 63%. The demographic characteristics of asthmatics who did not respond were similar to those who did. The response rate in this study can be compared to a response rate of 69% in Horn and Cochrane's study[11]. The difficulty of getting a complete sample was noted by Horn and Cochrane who reflected that McQueen and her colleagues who personally conducted a door-to-door survey were able to obtain information on only 80% of the households.

A cross country comparison

The demographic profile of Horn and Cochrane's study was similar to that found in this study (Table I). It is interesting to note, however, that in their study 80% of the patients had a childhood onset (under 10 years) whereas only 33% of our patients had their onset of asthma in childhood. This was also observed by Ross[15] in a study of patients seen in Penang. Ross

also compared the prevalence of childhood asthma reported in various studies of Asian populations and concluded that there were distinct differences in childhood asthma between Asian and British populations. We believe that exposure to allergens and the development of airway hypersensitivity in early childhood is less common in this part of the world. There were 2.3 times more current and ex-smokers combined in Horn and Cochrane's study compared to this study population (63.1% compared with 26.6%).

Trigger factors

The total management of asthmatic attacks must include attention to the avoidance of triggers. In the occupational context the hypersensitive person is usually deterred from continuing exposure to the offending agent. The use of powerful bronchodilators may, it is feared, over-ride this protective mechanism and allow the inflammatory reaction to continue to damage the bronchioles. In this study a quarter of the patients reported attacks provoked by the work environment; attention should be paid to prevent rather than suppress symptoms with more effective bronchodilators, particularly, powerful, long acting ones. Influenza, colds, house dust and cigarette were common provoking factors and they were similarly experienced in reported studies on patients seen in general practice[11,12].

Pets were a provoking factor in only 14% in this study compared to 42% and 39% respectively in Turner Warwick's study and Barritt and Staples' study. Most studies have noted that pets as a provoking factor is commonly under-recognised; this is found to be even more so in this study. Since 80% of the population of Singapore stay in apartments which make it inconvenient to keep pets, the less frequent contact with pets may also explain its small contribution as a trigger factor. Pollen is probably not an important factor locally or is under-recognised because unlike in temperate countries, seasons are less marked and therefore the pollen load is distributed evenly or moderately throughout the year.

Morbidity

The results of this study were not directly comparable with several reported studies[11-13] in the literature on outpatient populations because the duration that patients were asked to report their symptoms were variable, ranging from one month in Turner-Warwick's study[11] of reported cases from general practice to six months in Lim et al's study[13] of two general outpatient clinics in Pahang and one year in Horn and Cochrane's study[10] of patients seen in two general practices linked to a London hospital. Nevertheless, a common feature could be seen, namely, that there was considerable morbidity amongst the patients studied.

Thus, in Turner Warwick's study, 39% had nightly attacks; in Lim et al's series, 50% of the subjects had 4 or more night attacks per week. In this study, 17% had nightly nocturnal attacks. Nocturnal asthma is both common and serious. Nocturnal wheezing often impairs daytime cognitive performance. Unless every asthmatic patient is asked about his/her nocturnal symptoms, we will miss this important cause of impaired quality of life[14].

Drug use

As expected, beta-agonists were found to be the most common first time drug used for monotherapy, but it is interesting to note that oral tablets were much more commonly used than inhalers. We are not sure whether this reflects a particular prescription pattern influenced by the non-availability of beta-agonist inhalers or the difficulty gaining the patients' acceptance and usage of these delivery devices since a certain degree of technical skill has to be acquired.

Horn and Cochrane[16] noted that inhaled steroids were prescribed to only one-third of the patients overall in their study; less than half of the patients with an FEV_1 below 50% predicted were asked to use them. In this study, only 12.5% of the patients were on inhaled steroids. The current guideline is to prescribe inhaled steroids to patients who require inhaled bronchodilators more than once a day[3,4]. It would appear that inhaled steroids are under-used at the time the study was undertaken. New ideas about treatment take time to be adopted. This probably explains the current situation of infrequent inhaled steroid usage. For patients with nocturnal attacks, slow release preparations of theophylline will be useful in those not adequately controlled by beta-agonist and inhaled steroids; some of the patients in this study having nightly attacks but not on xanthines may benefit from including xanthines in their treatment regimens.

CONCLUSIONS

In common with recent studies elsewhere, this study showed that a sizeable proportion (20%) of asthmatics in outpatient clinics experience significant morbidity from their disease. Inhaled steroids appeared to be under used.

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